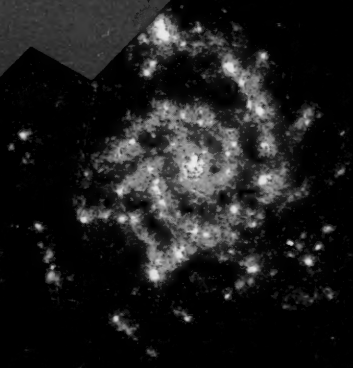
Scientific and Technical Aerospace Reports

STAR



An Abstract Journal

Volume 30, Number 6
March 23, 1992
N92-14966 to N92-15961

Scientific and Technical Aerospace Reports

Scientific and Technical Aerospace Reports (STAR) is an abstract journal that provides comprehensive coverage of worldwide aerospace-related reports. It is a major product of the International Aerospace Database managed by the NASA Scientific and Technical Information (STI) Program. The coverage includes reports on aeronautics, space, and supporting disciplines. *STAR* lists current, publicly available reports entered into the NASA STI Database during the 2-week period preceding publication. A typical citation and abstract appear on page viii. They explain how to read the items that are announced in this journal.

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88 SPACE SCIENCES (GENERAL) ..... **N.A.**

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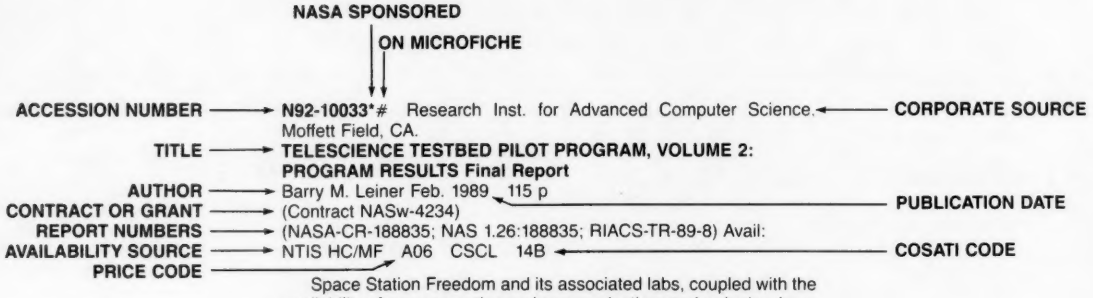
TYPICAL CITATION AND ABSTRACT



Space Station Freedom and its associated labs, coupled with the availability of new computing and communications technologies, have the potential for significantly enhancing scientific research. A Telescience Testbed Pilot Program (TTPP), aimed at developing the experience base to deal with issues in the design of the future information system of the Space Station era. The testbeds represented four scientific disciplines (astronomy and astrophysics, earth sciences, life sciences, and microgravity sciences) and studied issues in payload design, operation, and data analysis. This volume, of a 3 volume set, which all contain the results of the TTPP, contains the integrated results. Background is provided of the program and highlights of the program results. The various testbed experiments and the programmatic approach is summarized. The results are summarized on a discipline by discipline basis, highlighting the lessons learned for each discipline. Then the results are integrated across each discipline, summarizing the lessons learned overall.

Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N92-14966# David Taylor Research Center, Bethesda, MD.
AVIATION DIAGNOSTICS AND MAINTENANCE (ADAM) SYSTEM PRELIMINARY CONCEPT OF OPERATION AND FUNCTIONAL DESCRIPTION Final Report, Oct. 1990 - Sep. 1991
Raymond P. LeBeau, Mark T. Kramer, James R. Carlberg, Michael S. DePriest, and Harvey A. Eikel Sep. 1991 76 p
(AD-A242598; DTRC-91/017) Avail: NTIS HC/MF A05 CSCL 12/7

The Aviation Diagnostics and Maintenance (ADAM) System is an initiative to acquire, store, distribute, and use technical maintenance information for aircraft in a digitized, integrated, and task-oriented format. The initiative is consistent with DoD Computer-aided Acquisition and Logistics Support (CALS) direction and provides tools for Statistical Process Control (SPC) under Total Quality Management (TQM) concepts. While oriented toward new technology aircraft, segments of the concept have applicability to the existing Naval Aviation inventory. ADAM consists of a maintenance system equipped with state of the art hardware/software through which complete, current and consistent data will be made automatically available in electronic format to all maintenance technicians and production managers, thereby improving maintenance performance and unit readiness with reduced Life Cycle Costs (LCC). The ADAM system incorporates expert system diagnostic techniques, which interface with the aircraft's Built In Test (BIT) data, to generate subsets of optimized maintenance task information for fault isolation and repair processes. This maintenance task information will be available to the technician on both workcenter display devices and on portable display devices which can be used at the work site. GRA

N92-14967* National Aeronautics and Space Administration, Washington, DC.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 271)
Nov. 1991 184 p
(NASA-SP-7037(271); NAS 1.21:7037(271)) Avail: NTIS HC A09; NTIS standing order as PB91-914100, $17.00 domestic, $34.00 foreign CSCL 01B

This bibliography lists 666 reports, articles, and other documents introduced into the NASA scientific and technical information system in October, 1991. Subject coverage includes design, construction and testing of aircraft and aircraft engines; aircraft components, equipment and systems; ground support systems; and theoretical and applied aspects of aerodynamics and general fluid dynamics. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N92-14968*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
WIND TUNNEL INVESTIGATION OF VORTEX FLOWS ON F/A-18 CONFIGURATION AT SUBSONIC THROUGH TRANSONIC SPEED
Gary E. Erickson Washington Dec. 1991 166 p
(NASA-TP-3111; L-16799; NAS 1.60:3111) Avail: NTIS HC/MF A08 CSCL 01A

A wind tunnel experiment was conducted in the David Taylor Research Center 7- by 10-Foot Transonic Tunnel of the wing leading-edge extension (LEX) and forebody vortex flows at subsonic and transonic speeds about a 0.06-scale model of the F/A-18. The primary goal was to improve the understanding and control of the vortical flows, including the phenomena of vortex breakdown and vortex interactions with the vertical tails. Laser vapor screen flow visualizations, LEX, and forebody surface static pressures, and six-component forces and moments were obtained at angles of attack of 10 to 50 degrees, free-stream Mach numbers of 0.20 to 0.90, and Reynolds numbers based on the wing mean aerodynamic chord of 0.96 x 10(exp 6) to 1.75 x 10(exp 6). The wind tunnel results were correlated with in-flight flow visualizations and handling qualities trends obtained by NASA using an F-18 High-Alpha Research Vehicle (HARV) and by the Navy and McDonnell Douglas on F-18 aircraft with LEX fences added to improve the vertical tail buffet environment. Key issues that were addressed include the sensitivity of the vortical flows to the Reynolds number and Mach number; the reduced vertical tail excitation, and the corresponding flow mechanism, in the presence of the LEX fence; the repeatability of data obtained during high angle-of-attack wind tunnel testing of F-18 models; the effects of particle seeding for flow visualization on the quantitative model measurements; and the interpretation of off-body flow visualizations obtained using different illumination and particle seeding techniques. Author

N92-14969*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
NUMERICAL SIMULATION OF SWEPT-WING FLOWS Progress Report
Helen L. Reed Dec. 1991 55 p
(Grant NAG1-1158)
(NASA-CR-189457; NAS 1.26:189457) Avail: NTIS HC/MF A04 CSCL 01A

Efforts of the last six months to computationally model the transition process characteristics of flow over swept wings are described. Specifically, the crossflow instability and crossflow/Tollmien-Schlichting wave interactions are analyzed through the numerical solution of the full 3D Navier-Stokes equations including unsteadiness, curvature, and sweep. This approach is chosen because of the complexity of the problem and because it appears that linear stability theory is insufficient to explain the discrepancies between different experiments and

between theory and experiment. The leading edge region of a swept wing is considered in a 3D spatial simulation with random disturbances as the initial conditions. For individual titles, see N92-14970 through N92-14971.

N92-14970*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
EFFECT OF LEADING-EDGE GEOMETRY ON BOUNDARY-LAYER RECEPTIVITY TO FREESTREAM SOUND
Nay Lin, Helen L. Reed, and W. S. Saric *In its* Numerical Simulation of Swept-Wing Flows Dec. 1991 p 10-29 (For primary document see N92-14969 06-02)
(Grant AF-AFOSR-0234-90)
Avail: NTIS HC/MF A04 CSCL 01A

The receptivity to freestream sound of the laminar boundary layer over a semi-infinite flat plate with an elliptic leading edge is simulated numerically. The incompressible flow past the flat plate is computed by solving the full Navier-Stokes equations in general curvilinear coordinates. A finite-difference method which is second-order accurate in space and time is used. Spatial and temporal developments of the Tollmien-Schlichting wave in the boundary layer, due to small-amplitude time-harmonic oscillations of the freestream velocity that closely simulate a sound wave travelling parallel to the plate, are observed. The effect of leading-edge curvature is studied by varying the aspect ratio of the ellipse. The boundary layer over the flat plate with a sharper leading edge is found to be less receptive. The relative contribution of the discontinuity in curvature at the ellipse-flat-plate juncture to receptivity is investigated by smoothing the juncture with a polynomial. Continuous curvature leads to less receptivity. A new geometry of the leading edge, a modified super ellipse, which provides continuous curvature at the juncture with the flat plate, is used to study the effect of continuous curvature and inherent pressure gradient on receptivity. Author

N92-14971*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
LEADING-EDGE RECEPTIVITY TO A VORTICAL FREESTREAM DISTURBANCE: A NUMERICAL ANALYSIS
Thomas A. Buter and Helen L. Reed *In its* Numerical Simulation of Swept-Wing Flows Dec. 1991 p 30-52 Sponsored in cooperation with AFOSR (For primary document see N92-14969 06-02)
Avail: NTIS HC/MF A04 CSCL 01A

The receptivity to freestream vorticity of the boundary layer over a flat plate with an elliptic leading edge is investigated numerically. The flow is simulated by solving the incompressible Navier-Stokes system in general curvilinear coordinates with the vorticity and stream function as dependent variables. A finite-difference scheme which is second-order accurate in both space and time is used. As a first step, the steady basic-state solution is computed. Then a small amplitude vortical disturbance is introduced at the upstream boundary and the governing equations are solved time-accurately to evaluate the spatial and temporal growth of the perturbations leading to instability waves (Tollmien-Schlichting waves) inside the boundary layer. Preliminary results for a symmetric, 2-D disturbance reveal the presence of Tollmien-Schlichting waves aft of the flat-plate/ellipse juncture. Author

N92-14972# Ballistic Research Labs., Aberdeen Proving Ground, MD.
TRANSONIC NAVIER-STOKES COMPUTATIONS FOR A SPINNING BODY OF REVOLUTION Final Report, Jul. 1989 - Jul. 1991
Jubaraj Sahu Sep. 1991 43 p
(DA Proj. 1L1-61102-AH-43)
(AD-A241015; BRL-TR-3265) Avail: NTIS HC/MF A03 CSCL 20/9

A zonal, implicit, time-marching Navier-Stokes computational technique has been used to compute three dimensional transonic flow fields over a projectile. Flow field computations have been performed at M = 0.94 for spin rates of 0 and 4900 rpm and at angles of attack, alpha = 0,4, and 10 degrees. All the computations have been performed on the Cray-2 supercomputer. Details of the flow field such as Mach number contours and surface pressure distributions are presented. Computer surface pressures are compared with available experimental data for the same conditions and the same configuration. Computer results show the large circumferential pressure distribution over the boattail region as well as the nonlinear effect of the angle of attack. Aerodynamic force and moment coefficients (normal force, pitching moment, Magnus force, and Magnus moment) have been obtained from the computed pressures and are compared with the data. The computed results are generally in good agreement with the data at a low angle of attack for both nonspinning and spinning conditions. At a high angle of attack, the agreement is good for the nonspinning case and is less satisfactory for the spinning case. GRA

N92-14973# European Space Agency, Paris (France).
AEROTHERMODYNAMICS FOR SPACE VEHICLES
B. Battrick, ed. Jul. 1991 570 p In ENGLISH and FRENCH The 1st European Symposium was held in Noordwijk, Netherlands, 28-30 May 1991; sponsored by ESTEC, AAAF/CNES and DGLR/DARA/DLR
(ESA-SP-318; ISBN-92-9092-114-5; ETN-92-90680) Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

Papers concerning the development of aerothermodynamics for space vehicles, covering problems of high speed flight for advanced launchers, reentry vehicles and planetary landers are presented. The focus of the symposium was the new technology of 'aerothermodynamics', which includes classical aerodynamics, thermodynamics, and thermochemistry. The applications presented and discussed covered external flow over vehicles and internal flow through vehicle propulsion systems, at speeds ranging from the low subsonic, through transonic, to supersonic and hypersonic. The flight trajectories addressed included ascent to space from planetary surfaces, descent from space to planetary surfaces, flight through low density atmospheres, and aerobraking by atmospheric entry. For individual titles, see N92-14974 through N92-15043.

N92-14974# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Propulsion and Aerothermodynamics Div.
AEROTHERMODYNAMIC CHALLENGES FOR ESA PROGRAMMES
W. Berry *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 3-10 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

A history of aerothermodynamic activities in the European Space Resrach Organization/European Space Agency (ENRO/ESA) is given. Between 1964 and 1988 these were devoted to satellite aerodynamics for low Earth orbit missions and rocket engine exhaust plume dynamics. The creation of an aerodynamic capability at the European Space Research and Technology Center (ESTEC) is mentioned, and the programs involving substantial aerothermodynamics are listed. The aerothermodynamic challenges for future ESA mission in its science, Earth observation, and space transportation programs, are addressed, and design solutions offerred. Within the science programs the Cassini/Huygens, Rosetta, and Mars missions are considered. Within the Earth observation programs the Aristoteles mission is considered. Within the space transportation programs, Ariane-5, Hermes, and reusable winged launchers are considered. Design tools and engineering facilities needed for modern aerothermodyanmics are discussed; ESA's research and development activities in aerothermodynamics are addressed. One of these activities is to prepare and implement a Technology Research Program (TRP) designed to prepare the technology needed for Europe's space program. Activities in progress or planned within the TRP are addressed. They include development of Navier-Stokes algorithms, work in aerothermochemistry effects in hypersonic flows, work on parallel

processing for aerothermodynamics, transition criteria in hypersonic flows, and work on measurement techniques in hypersonic flows. ESA

N92-14975# Tsentralni Aerogidrodinamicheskii Inst., Moscow (USSR).
AEROTHERMODYNAMIC CONFIGURATION OF FIRST GENERATION AEROSPACE PLANES (OF BURAN-TYPE) AND FIRST FLIGHT RESULTS **c16**
V. Ya. Neiland *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 13-22 (For primary document see N92-14973 06-02)
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Some main factors influencing the Aerothermodynamics Configurations (ATC) of first generation aerospace planes, the problems to be solved during its selection, the phases of the ATC development, estimation methods for aerodynamic characteristics and heat fluxes, including laboratory experiments, numerical investigations and flight tests, are discussed. The circle of problems being considered is confined to the first generation aerospace planes of the type 'Buran'. Some data of fundamental importance concerning the convergence of aerothermodynamic characteristics preflight predictions with real flight test results are presented. ESA

N92-14976# Centre d'Etudes et de Recherches Anthropologie d'Appliquee, Paris (France). Aerodynamics Dept.
HYPERSONIC BOUNDARY LAYERS: TRANSITION AND TURBULENCE EFFECTS **c34**
D. Arnal and B. Aupoix *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 25-38 Previously announced in IAA as A89-25860 (For primary document see N92-14973 06-02)
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Theoretical and experimental results related to the problem of laminar turbulent transition at high speeds are surveyed. In the case of 'natural' transition, the linear stability theory can describe the development of Tollmien-Schlichting waves, of Goertler vortices (on concave walls) and of stationary vortices generated by cross flow instability (three dimensional flows). The problem of boundary layer tripping by large roughness elements is also studied in two dimensional as well as in three dimensional flows. Hypersonic turbulent boundary layers are considered. The importance of compressibility effects upon turbulence and the differences in turbulence structure between low and high speed boundary layers are discussed. Turbulence modeling problems specific to high speed flows are addressed. Some examples of hypersonic boundary layers computations are presented. ESA

N92-14977# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS TOOLS OF ONERA AND DLR FOR THE AEROTHERMODYNAMICS OF REENTRY VEHICLES **c18**
P. Barillot, J. M. Bousquet, G. Brenner, J. L. DaCosta, D. Devezeaux, P. Niederdrenk, R. Radespiel, P. Sagnier, and J. Schoene (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick, Germany, F.R.) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 39-46 Previously announced in IAA as A91-53246 (For primary document see N92-14973 06-02)
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Design analysis of space planes must include all flow phenomena occurring during the reentry phase of the flight. Aerodymanic and aerothermic tools must be able to treat hypersonic, supersonic and subsonic flow fields. In the frame of Hermes Technical Assistance (TA) for the National Center for Space Studies (CCNES), DLR and ONERA have improved their numerical tools in order to increase their capabilties. Euler codes are necessary to compute aerodynamic coefficients during the hyper/supersonic part of the flight. The Panel Method is used for subsonic flow. For aerothermal load calculations, engineering methods allow short term response. More sophisticated methods, such as coupled Euler/boundary layer solvers, are used to study critical design points, including nonequilibrium and wall catalycity phenomena. Navier-Stokes solvers are used to study separation phenomena. Examples of application are presented. They show the present capability of TA teams to perform aerothermodynamic evaluations for Hermes design. ESA

N92-14978# Saab-Space A.B., Linkoeping (Sweden). Aircraft Div.
VALIDATION OF A COMPUTATIONAL METHOD FOR LAMINAR HYPERSONIC FLOW AROUND BLUNT BODIES AND THE APPLICATION TO THE FULL HERMES SPACECRAFT
Bengt Winzell *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 51-59 Sponsored in part by Avions Marcel Dassault (For primary document see N92-14973 06-02)
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An investigation of a Navier-Stokes method for predicting heat loads on blunt bodies in hypersonic flight is presented. Grid density, temperature gradient monitoring and outflow boundary treatment are discussed. Examples of testcase computations and full vehicle simulation are given, using both perfect gas aerodynamics and high temperature equilibrium assumptions. ESA

N92-14979# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Space Science Dept.
AEROTHERMODYNAMICS EFFECTS DURING THE HUYGENS ENTRY PHASE
A. Velazquez, J.-P. Huot, and R.-C. Molina *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 61-66 (For primary document see N92-14973 06-02)
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A situation of interest for the Huygens entry phase is studied by using an axisymmetric finite element Euler code with nonequilibrium chemistry. The nonequilibrium shock layer at Mach 23 and 350 km above Titan's surface is analyzed because the largest heating rate is expected around that point. First, an atmosphere consisting of 100 nitrogen is considered. Then, the upstream chemical composition is changed to 96 percent nitrogen and 4 percent methane. In the latter case, CN formation is analyzed because of its importance as a strong radiator. Flow field quantities and mass fractions along the stagnation streamline are presented. Estimates are given for the convective and radiative heat fluxes. ESA

N92-14980# Alenia Spazio S.p.A., Naples (Italy).
AEROTHERMODYNAMIC DEVELOPMENT OF THE CARINA RE-ENTRY VEHICLE: CFD ANALYSES AND EXPERIMENTAL TESTS **c18**
A. Marzano, M. Solazzo, A. Sansone, A. Capuano, and G. Borriello *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 67-72 (For primary document see N92-14973 06-02)
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The CARINA (Italian acronym for unmanned reentry capsule) system is a microgravity payload carrier with reentry capability. In the frame of the design activities for the CARINA system, the aerothermodynamic characterization of the reentry vehicle is one of the most considerable efforts. Furthermore, the design aspects of such a vehicle are largely unexplored in Europe, requiring a technological program to support the development of the knowledge in this research area. After a tradeoff analysis and preliminary studies, a more in depth approach to the problem was planned. Two different driving lines are pointed out: the utilization of Computational Fluid Dynamics (CFD) tools and the contemporary development of an adequate experimental campaign. Test results, compared with the numerical predictions, are illustrated. ESA

N92-14981# Aeronautical Research Inst. of Sweden, Bromma.
HYPERSONIC FLOW PAST DELTA WING FLOW SIMULATED BY NAVIER-STOKES SOLUTIONS

S. Srinivasan, P. Eliasson, and A. Rizzi *In* ESA, Aerothermodyanmics for Space Vehicles Jul. 1991 p 73-78 (For primary document see N92-14973 06-02)
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Numerical simulations for the laminar hypersonic flow past a blunt edged delta wing were performed by solving the Navier-Stokes equations. These simulations were performed for four different angles of attack: 0, 15, 25, and 30 degrees. The Navier-Stokes equations were solved using the explicit finite volume-four stage Runge-Kutta scheme. The intent is to reach a reasonable understanding of the computed flow fields, including flow separation, shear layers, vortices, shock waves, and entropy losses, and also to study the effect of the angle of attack on the flow features. It was observed that in the case of blunt edged delta wings at high angles of attack, the hypersonic flow is dominated by a shear layer that separates just past the blunt leading edge forming a more distributed vortical region over the wing, rather than a concentrated vortex structure as observed at lower speeds. The solutions are analyzed and compared with available experimental data. The computed results agree qualitatively with the experimental data but not quantitatively. ESA

N92-14982# Societe Europeenne de Propulsion, Vernon (France).
FUNDAMENTAL RESEARCH APPLIED TO COMBUSTION IN ROCKET ENGINES [RECHERCHE FONDAMENTALE APPLIQUEE A LA COMBUSTION DANS LES MOTEURS FUSEE] **c20**
P. A. Baudart, T. Delaporte, and P. Clavin (Centre National de la Recherche Scientifique, Marseilles, France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 81-85 In FRENCH (For primary document see N92-14973 06-02)
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Research concerning numerical codes and tools for modeling and analysis of combustion phenomena in rocket engines is presented. Industrial problems of design and development of rocket engines are discussed. Physical problems including ignition and injection performance are considered. Basic studies for the research program include a numerical study of dense spray combustion. An application example is discussed. ESA

N92-14983# Societe Europeenne de Propulsion, Vernon (France).
NUMERICAL SIMULATION OF IGNITION IN A CRYOGENIC ROCKET CHAMBER [SIMULATION NUMERIQUE DE L'ALLUMAGE D'UNE CHAMBRE DE MOTEUR FUSEE] **c20**
P. A. Baudart, P. Danous, T. Delaporte, V. Duthoit, and J. C. Harlay *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 87-92 In FRENCH Previously announced in IAA as A91-41743 (For primary document see N92-14973 06-02)
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A program to investigate an apparent deficiency in the cryogenic H10 ignition stage of Ariane flights 15 and 18 was undertaken. Behavior analysis of the chamber requires descriptions of the oxygen (LOX) and hydrogen (regenerating circuit) supply circuit phenomenon as well as the actual burner. Numerical tools were used to show the significant gains achieved with a new ignition system employing optimization of cavity refilling and a much lower sensitivity to engine parameter variations (particularly on the side of H2). ESA

N92-14984# Societe Europeenne de Propulsion, Vernon (France).
SUPERSONIC COMBUSTION STUDIES [ETUDES EN COMBUSTION SUPERSONIQUE] **c20**
H. Zeller, D. Saucereau, and M. Desaulty (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Moissy-Cramayel, (France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 93-100 In FRENCH (For primary document see N92-14973 06-02)
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The potential advantage of the scramjet for space launch and research is discussed. Firsts results of theoretical and experimental studies on mixing, combustion, and supersonic boundary layer flow behavior are presented. ESA

N92-14985# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Goettingen (Germany, F.R.). Inst. for Experimental Fluid Mechanics.
SIMULATION REQUIREMENTS FOR RCS PLUME: FLOWFIELD INTERACTION MODELLING ON A WINGED REENTRY VEHICLE
T. Poertner *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 101-106 Sponsored by CNES (For primary document see N92-14973 06-02)
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During the initial phase of reentry, the control over a winged vehicle is to be achieved by the Reaction Control System (RCS). For reasons of safety and performance, the reliable prediction of the actual efficiency of a planned RCS configuration is necessary. For the realistic configuration, the interference flowfield is so complex that extrapolations from either existing realistic or too greatly simplified configurations will not yield reliable quantitative prediction of RCS efficiency. As the problem is not accessible to theoretical analysis, efforts should be focused on experimental investigations using realistic models of the intended configurations. For this purpose, simulation requirements are derived based on Shuttle related NASA experience. ESA

N92-14986# Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. of Hydraulic Machines and Fluid Mechanics.
A MULTIBLOCK FLOW SOLVER FOR INVISCID HYPERSONIC FLOWS
Jan B. Vos and C. M. Bergman (Royal Inst. of Tech., Stockholm, Sweden) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 109-114 Sponsored in part by Commission Suisse d'Encouragement des Recherches Scientifiques (For primary document see N92-14973 06-02)
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The development of multiblock flow solvers on structured grids is considered. The present version of the solver solves the three dimensional Euler equations for transonic, supersonic, and hypersonic flows. The Euler equations are solved by the finite volume method using a space centered, explicit time marching scheme augmented by artificial dissipation terms. Equilibrium and nonequilibrium air chemistry were implemented. The multiblock solver is written on top of the MEL-COM data base system, and uses a dynamic memory manager to allocate the storage for the variables in each block. Results of multiblock calculations for the flow over a wedge and of single block calculations for the flow around the Hermes Manned Spaceplane at 76 km altitude are presented. ESA

N92-14987# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (Germany, F.R.). Inst. for Design Aerodynamics.
STEPS TOWARDS AN EFFICIENT AND ACCURATE METHOD SOLVING THE EULER EQUATIONS AROUND A RE-ENTRY CONFIGURATION AT SUPER- AND HYPERSONIC SPEED
J. Schoene, T. Streit, and N. Kroll *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 115-120 Sponsored in part by CNES (For primary document see N92-14973 06-02)
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Modifications and extensions of a Euler code which enable efficient computations of accurate solutions for supersonic and moderate hypersonic flows are described. These modifications involve a more robust central spatial discretization as well as the implementation of an upwind biased discretization operator. In order

to increase the efficiency of the code, a space marching technique is incorporated within regions with supersonic flow only. The resolution of the flow field in the domain of interest is enhanced through the adaptation of the far field to the bow shock. Numerical results of a Hermes type configuration at supersonic and moderate hypersonic speeds are presented. The accurate prediction of discontinuities using the upwind formulation is demonstrated. The advanatge of far field adaptation and space marching technique is verified. Comparisons with experimental data show that methods based on the equations of inviscid flow can predict flight mechanical derivatives with high accuracy. ESA

N92-14988# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Analysis and Programming Section.

FAST FINITE ELEMENT SOLVERS FOR REENTRY FLOWS

J.-P. Huot, R.-C. Molina, and D. Ferrer-Pellicer *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 121-127 (For primary document see N92-14973 06-02)

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A methodology for the solution of the three dimensional Euler equations with chemistry effects (valid for the supersonic hypersonic range) is presented. It relies on the commercially available Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) system CAEDS for the description of the geometries and the postprocessing of the results. The mesh generation is performed with an efficient multiblock three dimensional mesh generator interfaced with CAEDS. The Euler equations are solved with a fully vectorized finite element code that uses one point integration, resulting in speeds comparable to that of finite volume solvers. ESA

N92-14989# Center for Mathematics and Computer Science, Amsterdam (Netherlands).

MULTI-DIMENSIONAL UPWIND SCHEMES, MULTIGRID AND DEFECT CORRECTION FOR ACCURATE AND EFFICIENT EULER FLOW COMPUTATIONS

B. Koren and P. W. Hemker *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 129-134 Sponsored in part by Avions Marcel Dassault-Breguet Aviation (For primary document see N92-14973 06-02)

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Two multidimensional upwind discretizations for the steady Euler equations are presented, one with a good multigrid efficiency and the other with a good multidimensional accuracy. The two discretizations consist of a one dimensional Riemann solver with locally rotated left and right cell face states. For nonhypersonic flow computations, a standard nonlinear multigrid iteration is applied. For hypersonic flow computations, a nonlinear multigrid technique with improved robustness is presented. The robustness improvements consist of local damping of the restricted defect and a global upwind prolongation of the correction. For the steady, two dimensional Euler equations, numerical results are presented first, for some supersonic test cases with an oblique contact discontinuity and an oblique shock wave. Results for a hypersonic reentry flow around a blunt forebody with canopy are also shown. ESA

N92-14990# International Centre for Numerical Methods in Engineering, Barcelona (Spain).

FLOW AND TEMPERATURE COMPUTATIONS FOR SPACE VEHICLES USING ADAPTIVE FINITE ELEMENT TECHNIQUES

F. Quintana, E. Onate, and J. Miquel Canet *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 135-140 Sponsored in part by Instituto de Cooperacion Iberoamericana (For primary document see N92-14973 06-02)

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Computations of the laminar Navier-Stokes equations in hypersonic cases are studied using an explicit finite element method with adaptive non-structured mesh techniques to capture, accurately, the strong variations of the boundary layer and shocks. A pressure switched artificial dissipation is added to prevent oscillations in the vicinity of discontinuities. Some of the problems solved are discussed. ESA

N92-14991# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FUNDAMENTAL EXPERIMENTAL STUDIES OF CONTROL EFFECTIVENESS AND HEATING AT HYPERSONIC MACH NUMBERS

G. Simeonides and J. F. Wendt *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 143-148 (For primary document see N92-14973 06-02)

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Experimental results on shock wave boundary layer interactions over two and three dimensional flat plate/comparison ramp configurations at Mach numbers of 6 and 14, covering a range of Reynolds numbers to the hinge line (or apex of the swept ramps) between 300,000 and 2,600,000 are summarized. The interactions are found to act as effective trips of the boundary layer and, in some cases, transitional reattachment is observed. Configurations over which transition occurs dowstream of the reattachment point may seve as computational fluid dynamics code validation test cases. Analytical and semi empirical prediction methods, originally developed for two dimensional interactions, are seen to perform satisfactorily in predicting the global features of both two and three dimensional interactions. ESA

N92-14992# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Goettingen (Germany, F.R.). Inst. for Theoretical Fluid Mechanics.

BASE PRESSURE MEASUREMENTS ON A CONE AT HYPERSONIC MACH NUMBERS: A CONTRIBUTION TO AEROTHERMODYNAMICS FOR SPACE VEHICLES

M. Tanner *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 149-153 (For primary document see N92-14973 06-02)

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Base pressure measurements performed in a 6.8 degrees cone at Mach number from M infinity = 4.99 to 6.83 at angles of incidence from alpha = 0 to 15 degrees in turbulent flow are described. The results show that the base pressure is for these Mach numbers practically independent of the angle of incidence alpha for these relatively small alpha values. The results are approximately in agreement with those achieved during free flight measurements at full scale Reynolds numbers indicating that in turbulent flow the base pressure does not depend on the Reynolds number. In a discussion concerning some theoretical methods for the prediction of base pressure it is shown that the author's theory gives results, which are in very good agreement with experiments. ESA

N92-14993# Cranfield Inst. of Tech., Bedford (England). College of Aeronautics.

FLOW OVER A DELTA WING AT HYPERSONIC SPEEDS

H. Babinsky and J. L. Stollery *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 155-158 (For primary document see N92-14973 06-02)

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The flow over the lower surface of a simple hypersonic vehicle fitted with trailing edge flaps was studied by taking pressure measurements in a hypersonic gun tunnel at M = 8.2 and Re = 6,300,000/m. Flow visualization was carried out with Schlieren photographs and liquid crystals. All experiments indicated a large separated area due to the pressure rise on the flap. The large heating near the reattachment line was indicated by the liquid crystal experiments. The shape of the separated region proved to be strongly influenced by the local state of the boundary layer. The presence of the forebody and the interaction of the bow

shock with the boundary layer on the wing caused large changes in the local separation position. ESA

N92-14994# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Wind Tunnel Div.
EXPERIMENTAL STUDY OF HYPERSONIC SHOCK WAVE BOUNDARY LAYER INTERACTIONS BY MEANS OF INFRARED TECHNIQUE
A. Henckels, P. Herzog, and F. Maurer *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 159-164 Sponsored by DFG (For primary document see N92-14973 06-02)
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Convective surface heating due to shock wave boundary layer interaction phenomena is a critical problem for the design of thermal protection systems of future hypersonic vehicles. Tunnel experiments are presented which demonstrate how interaction phenomena can be visualized by infrared thermovision; the infrared image indicates the position of flow separation and reattachement by the temperature pattern. The capability of the used measurement technique is demonstrated and thereby the nature of shock wave boundary layer interaction is studied. The three dimensional ramp flow field, an impinging shock wave boundary of a flat plate, and an axial corner configuration under 20 degrees angle of attack were investigated. All test runs were performed in a hypersonic blow down facility at Mach numbers 6.0 and 8.7 for laminar flow condition. One interesting result achieved is the evidence that Goertler vortices are generated on a flat plate due to shock wave boundary layer interaction. ESA

N92-14995# Societe d'Etudes et de Services pour Souffleries et Installations Aerothermodynamiques, Paris (France). Lab. d'Aerothermique.
EXPERIMENTAL INVESTIGATION OF TRANSVERSE JET EFFECTS RELATED TO HYPERSONIC SPACE VEHICLES
J. Allegre, M. Raffin, and J. P. Caressa (Centre National de la Recherche Scientifique, Meudon-Bellevue, France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 165-170 (For primary document see N92-14973 06-02)
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Some indication on the flow interaction process which is associated with jet controls is given. A few examples of flight results on reaction control jets were presented for the Space Shuttle Orbiter. Some comparisons, with preflight predictions extrapolated from wind tunnel data obtained at lower Mach numbers and at a higher density, show some discrepancies mainly for the early stage of reentry. Experiments were carried out under rarefied hypersonic flow conditions on delta wings with trailing edge jet spoilers. Quantitative data show the jet effects in the measured aerodynamic coefficients. For the strong interaction flow regime and at various wing angles of attack, experimental results demonstrate the jet spoiler efficiency as compared with a solid spoiler efficiency. At a Mach number of 20 and under rarefied flow conditions, some preliminary experimental investigations were initiated on the Hermes model equipped with pitch reaction jet controls. It was found that at high altitudes, the flow rarefaction leads to very low efficiencies of control surfaces. For orbital flight conditions, jet control systems are than necessary to provide the required space vehicle maneuvering. Also, during the early phase of reentry, jets are used, sometimes in concert with control surfaces, to provide the vehicle aerodynamic control. ESA

N92-14996# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
INTERFERENCE HEATING NEAR FIN/BODY JUNCTIONS ON HYPERSONIC VEHICLES
Z. U. Haq, G. T. Roberts, and R. A. East *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 171-176 Sponsored by RAE (For primary document see N92-14973 06-02)
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Surface heat transfer and pressure data are presented for flat plate/fin configurations tested in an intermittent hypersonic wind tunnel at Mach 6.85. The heat transfer data were deduced from color images which show the response of thermochromic liquid crystals to the transient heating of the model of the flow. In particular, localized areas of high heat flux were apparent in the interference zones adjacent to the fin/body junction. The pressure data obtained for two fin configurations showed similar features, indicating some relationship between surface heat transfer and pressure. The influence of fin bluntness and sweep on the interference heating are described. ESA

N92-14997# Rome Univ. (Italy). Dipartimento di Meccanica e Aeronautica.
NUMERICAL SOLUTION OF DISCONTINUITY DYNAMICS: TWO DIMENSIONAL SUPERSONIC FLOWS
M. DiGiacinto and B. Favini *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 179-188 (For primary document see N92-14973 06-02)
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A floating-shock-fitting technique for the solution of compressible inviscid flows is presented. In a previous paper the proposed technique was applied for solving unsteady one dimensional problems and is extended here to two dimensional steady supersonic flows with special attention to the treatment of geometrical boundaries. A distinguishing feature of the method is the solution procedure for the governing equations at grid points and at discontinuity points whose domain of dependence consists of both space like and time like arcs. The present formulation of mixed initial boundary value problems prompts a correct and robust procedure for handling crossings and reflections of discontinuities, and at the same time, it greatly simplifies the design of the algorithm. Some methodological considerations are presented in order to clarify the proposed approach and to stress its validity. Numerical test cases confirm the consistency of the scheme and demonstrate its robustness. ESA

N92-14998# Institut National de Recherche d'Informatique et d'Automatique, Valbonne (France).
NUMERICAL SIMULATIONS AROUND MODELS IN HYPERSONIC WIND TUNNELS
R. Abgrall and A. Merlo *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 189-195 Prepared in cooperation with Centre National de la Recherche Scientifique, Marseilles, France (For primary document see N92-14973 06-02)
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Some very preliminary results about the problem of extrapolating the results obtained in wind tunnel to real flight conditions are related. Two experiments are proposed (the geometry is axisymmetric in both cases). The first one is the simulation of the complete nozzle with a model inside. The conditions at infinity for the models are nonuniform, in chemical and vibrational nonequilibrium. In the second experiment, the same model with an appropriate scaling parameter is considered where the conditions at infinity are obtained with the same Mach number, velocity and binary scaling parameter but with a uniform flow at chemical and vibrational equilibrium. Since this is only a preliminary study, the flows are assumed to be inviscid. The physical and chemical model used is detailed. The numerical scheme is described and the two numerical experiments performed are discussed. ESA

N92-14999# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Aerothermodynamics Section.
SIMOUN AND SCIROCCO WIND TUNNEL NOZZLE VISCOUS FLOW STUDY **c09**
D. Giordano, L. Marraffa, and G. Russo (Centro Italiano Ricerche Aerospaziali, Naples.) *In its* Aerothermodynamics for Space

Vehicles Jul. 1991 p 197-207 (For primary document see N92-14973 06-02)
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The results obtained during a first study phase about the flow fields in the SIMOUN and Scirocco wind tunnel nozzles are presented. The geometrical configurations analyzed here are conical with circular section of Scirocco and contoured with semicircular section for SIMOUN. Air is the working fluid and it was assumed to behave as an ideal gas in chemical and thermal equilibrium. Two dimensional and three dimensional results were produced by SPEAR/3D, a computer program which solves the parabolized Navier-Stokes equations. Isoline contours and transversal profiles of flow field parameters are shown to give an understanding of the flow patterns which settle on the nozzles under different operating conditions. The flow field characteristics and the limitations deriving from the assumptions on which the calculations were based are discussed; accordingly, future developments of the study are envisaged. ESA

N92-15000# Centro Italiano Ricerche Aerospaziali, Naples.
HIGH ENTHALPY NOZZLE FLOWS
G. Russo, Salvatore Borrelli, G. Leone, and Antonio Schettino *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 209-220 Sponsored in part by Italian Space Agency and CNES (For primary document see N92-14973 06-02)
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High enthalpy nozzle flows such as those that will be generated in the Hermes related Scirocco plasma wind tunnel are dealt with. The analysis of physical phenomenologies is made by means of a calculation procedure. The chemical and vibrational nonequilibrim effects are evidentiated with respect to the specific nozzles performance and an attempt to generalize the results in terms of parametric dependencies is made. ESA

N92-15001# Deutsche Airbus G.m.b.H., Bremen (Germany, F.R.).
SHORT TIME FORCE MEASUREMENT SYSTEM c09
Josef Mertens and Klaus Koenig *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 223-227 (For primary document see N92-14973 06-02)
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The development of the SFS (Short time Force and moment measurement System) is considered. It enables measurement of aerodynamic forces and moments at testing times of less than 10 ms. This is required for measurements in high enthalpy shock tunnels to simulate reentry flight. Measurement is done using distributed accelerometers. The one year development program will comprise: development of software for modal analysis, correction and evaluation, development of a suited suspension system, development of calibration methods, test loading of a generic model with a precise load on a shock tube's endwall. ESA

N92-15002# Naples Univ. (Italy).
INFRARED MEASUREMENTS OF AERODYNAMIC HEATING IN HYPERSONIC WIND TUNNEL c09
L. deLuca, G. Cardone, G. M. Carlomagno, T. AlziarydeRoquefort, and D. AymerdelaChevalerie (Centre d'Essais Aeronautique Toulouse, Poitiers, France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 229-234 Sponsored by Centro Italiano Ricerche Aerospaziali and Avions Marcel Dassault-Breguet Aviation (For primary document see N92-14973 06-02)
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Significant results referring to flow visualizations and heat transfer measurements performed by means of an infrared scanning radiometer in a blowdown hypersonic wind tunnel on delta wing and ellipsoids models are discussed. Tests are carried out within the European Community space program Hermes to develop the first European space shuttle. Comparisons of infrared data with oil film flow visualizations, thermocouple measurements and numerical results are presented. ESA

N92-15003# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Div. de Thermophysique.
HEAT TRANSFER MEASUREMENTS IN ONERA SUPERSONIC AND HYPERSONIC WIND TUNNELS USING PASSIVE AND ACTIVE INFRARED THERMOGRAPHY c09
D. L. Balageas, D. Boscher, A. A. Deom, and G. Gardette *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 235-240 Previously announced in IAA as A91-45632 Sponsored in part by Direction des Recherches, Etudes et Techniques; CEA; and Cryospace Co. (For primary document see N92-14973 06-02)
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Over the past few years, a major intellectual and technical investment has been made at ONERA to use data acquisition systems and data reduction procedures using an infrared camera as a detector under routine wind tunnel conditions. This allows a really quantitative mapping of heat tranfer rate distributions in models in supersonic and hypersonic flows. Sufficient experience has been required, and an overview of the following is given: the systems and data reduction procedures developed for both passive and active methods; typical results obtained various configurations such as supersonic axisymmetrical flow around an ogival body (passive and active thermography), heat flux modulation in the reattachment zone of a flap in hypersonic regime, transitional heating in very slightly blunted spheroconical bodies in hypersonic flows, and materials testing in high enthalpy hypersonic flow (passive thermography). ESA

N92-15004# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Div. de Thermophysique.
ABLATION AND TEMPERATURE SENSORS FOR FLIGHT MEASUREMENTS IN REENTRY BODY HEAT SHIELDS c35
J. J. Cassaing, D. L. Balageas, A. A. Deom, and J. C. Lestel *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 241-246 Sponsored in part by CEA and Aerospatiale (For primary document see N92-14973 06-02)
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Since 1977, Onera has ground and flight tested different techniques for heat shield recession: acoustic and combined temperature/ablation optical measurements. This last technique uses a gage that views the radiation optically from a cavity embedded within the heat shield. Flight measurements, both of temperature and of passage of the ablation front are compared with data generated by a predictive numerical code. The ablation and the heat diffusion into the instrumented ablator can be simulated numerically to evaluate accurately the errors due to the presence of the gage. The ablation measurement alone of the reentry body nose is made by an acoustic gage. The temperature measurement alone of the heatshield inner wall will be soon carried out by an optical sensor. ESA

N92-15005# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Military Aircraft Div.
VERIFICATION AND APPLICATION OF THE NSFLEX METHOD FOR HYPERSONIC FLOW CONDITIONS
K. M. Wanie and M. A. Schmatz *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 249-257 (For primary document see N92-14973 06-02)
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The need of hypersonic reentry and cruise vehicle design to calculate viscous flow past entire configurations with wings, fins, flaps and propulsion system represents one of the major challenges for computational fluid dynamics. There is, however, still a considerable lack of experience for hypersonic flow calculations and therefore an extensive testing and verification of the numerical methods and physical modeling is essential. The verification of

the multiblock Navier-Stokes code NSFLEX and its application to hypersonic flow problems is thus focused upon. The governing equations and the solution method are reviewed. The fundamental details of the multiblock incorporation, like indirect addressing and use of boundary indicators, are described. The verification is done by geometrically simple test cases. The capabilities of the method are demonstrtated for realistic hypersonic configurations. ESA

N92-15006# Fluid Gravity Engineering Ltd., Witley (England).
HYPERSONIC AEROTHERMODYNAMIC COMPUTATIONS USING A POINT-IMPLICIT TVD METHOD
M. P. Netterfield *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 259-266 (For primary document see N92-14973 06-02)
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Validation cases which are typical of hypersonic reentry problems are presented for a three dimensional Navier-Stokes code with fully coupled nonequilibrium thermochemistry. The code uses a Total Variation Diminishing (TVD) formulation for the inviscid fluxes, a point implicit relaxation method of time marching, and a 2 temperature thermodynamic model, with source terms also treated in a point implicit manner. The validation cases presented include the hypersonic laminar flow over a compression corner, and high enthalpy chemically reacting flow over a circular cylinder. ESA

N92-15007# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).
EFFICIENT SOLUTION OF THREE-DIMENSIONAL VISCOUS HYPERSONIC FLOWS
S. Menne *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 267-272 (For primary document see N92-14973 06-02)
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The Time Integration Block Marching (TIBM) method is presented in order to show a way for an efficient solution of the Navier-Stokes equations for space planes with complex geometries. The TIBM method combines the advantages of marching methods and the advantages of complete solvers. Main applications for the TIBM method are mostly supersonic flows with strong interaction regions of limited range. The complete Navier-Stokes equations are solved in these regions whereas in the other regions a marching solution is executed using a marching block consisting of a small number of cross flow planes. For validation, the TIBM method was applied to several flow problems. Some cases are presented: the flow over a two dimensional ramp with flow separation, and three dimensional flows over a yawed cone, over a two stage transport vehicle and over a blunt nosed delta wing. ESA

N92-15008# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Military Aircraft Div.
VISCOUS SHOCK-LAYER EQUATIONS FOR THE CALCULATION OF REENTRY AEROTHERMODYNAMICS
Roland K. Hoeld *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 273-280 (For primary document see N92-14973 06-02)
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Three dimensional Viscous Shock Layer (VSL) equations, which are derived from the Navier-Stokes equations by an order of magnitude analysis, are presented. They hold for the windward flow field of reentry vehicles at hypersonic flow conditions. Rarefaction effects are modeled at the body surface and at the bow shock by slip boundary conditions. Results of the VSL code 'VISSLA' for equilibrium real gas calculations are discussed. The influence of the slip boundary conditions, coming along with growing Knudsen numbers of the higher altitudes of reentry trajectories, is demonstrated. Comparisons with other computationa fluid dynamic codes like 'NSFLEX' (Navier-Stokes calculation) show the accuracy of the VSL equations and verify the code. ESA

N92-15009# Stuttgart Univ. (Germany, F.R.). Inst. fuer Raumfahrtsysteme.
THE IRS PLASMA WIND TUNNELS FOR THE INVESTIGATION OF THERMAL PROTECTION MATERIALS FOR REENTRY VEHICLES **c09**
M. Auweter-Kurtz, H. Habiger, S. Laure, E. W. Messerschmid, W. Roeck, and N. Tubanos *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 283-293 (For primary document see N92-14973 06-02)
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The plasma wind tunnels PWK1 and PWK2 were designed to test thermal protection materials for space vehicles. They are suitable for the qualification of ablative materials as well as for heat resistant ceramics such as C-C or C-SiC. In either case, a steady state heating environment including transient conditions at the surface of space transportation systems during the early reentry phase are simulated as close to reality as possible. Such plasma wind tunnels represent the only possible way to investigate candidate materials with respect to their surface chemistry associated with erosion or ablation behavior. In these facilities, the emphasis is on reproducing the specific enthalpy of the flow, the wall temperature and heat flux respectively as well as the chemical composition with respect to the main and most reactive components on the surface of the tested specimens rather than aerodynamic similarities. The plasma wind tunnels are characterized in terms of specific enthalpy, pressure, heat flux, and mass flow. The simulation requirements are discussed with respect to the erosion mechanisms of modern heat shield materials. It is shown that the environment of the nose cap and at the leading edge of Hermes during the first phase of reentry, including the points of maximum temperature, can be simulated as well as the conditions during the reentry of the space probe Rosetta. ESA

N92-15010# Eurespace, Blagnac (France).
SIMULATIONS OF REENTRY CONDITIONS BY PLASMA GENERATOR: THEORETICAL AND PRACTICAL LIMITS [SIMULATIONS DES CONDITIONS DE RENTREES PAR GENERATEUR DE PLASMA LIMITES THEORIQUES ET PRATIQUES] **c09**
Serge Muller *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 295-299 In FRENCH (For primary document see N92-14973 06-02)
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Development of thermal protection materials and hypersonic engines requires test means in which the air is carried at very high temperature into plasma generators electromagnetically (electric arc induction). Different technologies were used showing advantages and disadvantages in terms of performance, pollution, installation cost, and utilization. The technological limits of plasma generators in terms of enthalpy and generating pressure enable simulation possibilities to be defined. ESA

N92-15011# Laboratoire d'Aerothermique du CNRS, Meudon (France).
PLASMA JET WIND TUNNEL SIMULATION OF ATMOSPHERIC REENTRY [SIMULATION EN SOUFFLERIE DE PLASMAS D'ENTREE D'UN VEHICULE EN REGION ATMOSPHERIQUE] **c09**
P. Lasgorceix, M. A. Dudeck, and J. P. Caressa *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 301-305 In FRENCH (For primary document see N92-14973 06-02)
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Three plasma wind tunnels were used to simulate steady atmospheric reentry plasma jets. Electronic density and temperature were measured by electrostatic probes. Ion and neutral concentrations were obtained by quadrupole mass spectrometry and the flow velocity by different techniques (magnetohydrodynamic effect, flight time, cross probes). An optical spectrometer was used to determine the rotational temperature (N2+). The plasma

generators were tested with different gases: argon, nitrogen, air, and a nitrogen-methane mixture. ESA

N92-15012# Naples Univ. (Italy).
ASPECTS OF NON-EQUILIBRIUM IN ARC-HEATED WIND-TUNNEL SIMULATION **c09**
R. Monti, G. Russo, and G. Pagliocca (Techno System Developments, Naples, Italy) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 307-314 (For primary document see N92-14973 06-02)
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Problems of the air flow in continuous arc heated wind tunnels and in the different parameters that characterize the flow field in the test section are addressed. Pressure, velocity, and dimension are not sufficient to duplicate the flight conditions due to nonequilibrium effects; this is especially true for heat transfer problems in reentry conditions. Wind tunnel experimental results cannot duplicate the results of real flight conditions, because of the different contributions of the sensible, chemical, and kinetic energies to the total enthalpy of the air flow. In particular, air flow evolution behind shock waves over blunt bodies was considered and the main parameters are evaluated at different nonequilibrium conditions in the test section. Numerical analysis and considerations are related to the present and potential capabilities of the arc heated continuous plasma wind tunnel (Scirocco). ESA

N92-15013# Naples Univ. (Italy).
LINEAR ACOUSTICS IN GAS MIXTURES WITH RATE PROCESSES **c71**
Luigi G. Napolitano *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 317-324 (For primary document see N92-14973 06-02)
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Linear acoustics in an unbounded medium in which an arbitrary number of independent rate processes (chemical reactions and/or excitations on internal degrees of freedom) take place are dealt with. The medium is supposed to be in an initial quiescent and full equilibrium state and all diffusion processes are assumed to be negligible. (Linear acoustics without neglection of diffusion processes or in nonquiescent media and nonlinear acoustics with and without diffusion processes are not dealt with). The extremely simplified case dealt with is nonetheless very useful. It allows for the following: elucidation of the role played by a number of basic notions of thermodynamics such as equilibrium and stability; quantification of the 'response' of the media to small disturbances; and suggestion of diagnostic techniques which may be used to study the kinetics of rate processes and their couplings, and so forth. Equilibrium and nonequilibrium thermodynamics of composite systems as specialized to the subject case are considered. The field equations and their linearized form appropriate to the study of linear acoustics are addressed, as are the general features of linear acoustics, dispersion equation, and properties of the acoustic susceptibility. ESA

N92-15014# Centre National de la Recherche Scientifique, Chatenay-Malabry (France).
HYPERSONIC VISCOUS SHOCK LAYER IN THERMOCHEMICAL NONEQUILIBRIUM
F. Thivet, S. Candel, and M. Y. Perrin *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 325-333 Sponsored by Avions Marcel Dassault; Direction des Recherches, Etudes et Techniques; and CNRS (For primary document see N92-14973 06-02)
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The basic features of a hypersonic flow are reviewed and some models for equilibrium thermodynamic properties, chemical kinetics, and transport properties of air at high temperatures are presented. To precisely describe the stagnation regions of a typical reentry vehicle, the aerodynamics of the flow is reduced to the viscous shock layer approximation. An original and fast method is presented to solve the resulting free boundary parabolic system of equations based on Newton iterations on a fixed boundary domain. A vibrational nonequilibrium model is introduced in order to determine the sensitivity of the flow to this phenomenon. The relaxation equations resulting from the kinetic theory are presented. The relaxation times involved are calculated using an extension of the SSH theory and on some experimental data. The full coupling between vibrational and chemical nonequilibrium is taken into account. The influence of these phenomenon is made evident in results obtained for different geometries. ESA

N92-15015# Centro Italiano Ricerche Aerospaziali, Naples.
INFLUENCE OF CHEMICAL MODELLING ON HYPERSONIC FLOW
Salvatore Borrelli and Antonio Schettino *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 335-341 Sponsored in part by Italian Space Agency (For primary document see N92-14973 06-02)
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Upwind methods and the influence of chemical models are considered. An extension of an upwind methodology to the case of a nonequilibrium reacting and vibrating flow is presented and the influence of thermokinetic modelization is considered. Two classical chemical models are compared, with adding vibrational effects. The two chemical models are the Park 85 and Evans-Huber-Schexnayder. ESA

N92-15016# Rome Univ. (Italy). Dipartimento di Meccanica e Aeronautica.
INFLUENCE OF CHEMICAL MODELING ON THE SOLUTION OF HYPERSONIC SHOCK LAYERS
F. Sabetta, B. Favini, and M. Onofri *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 343-347 (For primary document see N92-14973 06-02)
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Hypersonic flows about ellipses at high angle of attack are analyzed by means of nonequilibrium, equilibrium, and inert gas with gamma = 1.2 models. It is shown that the proposed technique of chemical rate equation integration marching along streamlines allows the nonequilibrium model to accurately compute the stagnation point conditions where equilibrium must be attained. The comparison between the three model results indicates that the equilibrium model can not be considered an acceptable approximation in computing hypersonic flow fields, since it underpredicts the blowshock stand off distance and overpredicts the call temperature. The inert gas model with gamma = 1.2 can only be used as a crude approximation for evaluating the wall pressure. ESA

N92-15017# OHB-System G.m.b.H., Bremen (Germany, F.R.).
FALKE AND COBRA TECHNOLOGY DEVELOPMENT IN AERODYNAMICS AND AEROTHERMODYNAMICS
B. Steckemetz, J. Ewald, W. Wienss, A. Tegtmeier, C. Friebel, and Georg Koppenwallner (Hyperschall-Technologie-Goettingen, Germany, F.R.) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 351-358 Previously announced in IAA as A91-13281 (For primary document see N92-14973 06-02)
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Wind tunnel measurements and numerical methods are well established tools to simulate the actual flow around aerodynamically supported vehicles in atmospheric flight. There are, however, limitations e.g., in the transonic and hypersonic flight regime caused by noncompliance with similarity laws, viscosity and heat conductance effects, chemical kinetics, etc. which strongly influence the accuracy of measurements and numerical calculations. Major results of two projects are reported. Both projects aim at supporting wind tunnel measurements and numeric simulations by test flights under free flight conditions. The FALKE

project mainly covers the transonic and lower supersonic flight conditions, whereas COBRA is intended to cover the hypersonic speed regime. ESA

N92-15018# Aerospatiale, Les Mureaux (France). Theoretical Aerodynamic Branch.

NUMERICAL SIMULATION OF NON-EQUILIBRIUM VISCOUS FLOWS IN HYPERSONIC NOZZLES

V. Mulard and Gilles Moules (Segime, Les Mureaux, France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 359-364 Sponsored by Avions Marcel Dassault (For primary document see N92-14973 06-02)

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Hypersonic nozzle facilities have been activated for the simulation of real gas effects over Hermes Space Plane during reentry. For each experimentation, the complete rebuilding of the flow inside the wind tunnel is needed for further exploitations of the experimental results. An industrial numerical tool which has the ability to determine the wind tunnel flow characteristics is presented. The approach takes advantage of the specific physical behavior of the flow, namely, equilibrium flow at the entrance, nonequilibrium flow behind the throat, and frozen flow at the exit in order to calculate the flow field with the most suitable codes and at a low computing cost. Applications to Marseille and SIMOUN nozzle facilities are presented and show the feasibility of the present approach. ESA

N92-15019# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

THE DYNAMIC RESPONSE OF SEPARATED HYPERSONIC FLOWS

A. J. D. Smith and R. A. East *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 365-370 (For primary document see N92-14973 06-02)

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The dynamic response of a separated hypersonic flow to a rapidly actuated trailing edge flap was investigated. Experimental measurements showed a lag in the rate of separation growth, which was attributed, principally, to the requirement for mass entrainment. Measurements of heat transfer for the evolving dynamic separation have an increased level in the reattachment region at high flap angles, in excess of that for equivalent steady separated flows. Simple analytic models were developed which support the proposed mechanisms of unsteady separated flow adjustment. ESA

N92-15020*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

AERODYNAMIC HEATING ON AFE DUE TO NONEQUILIBRIUM FLOW WITH VARIABLE ENTROPY AT BOUNDARY LAYER EDGE

P. C. Ting, W. C. Rochelle, S. A. Bouslog, L. T. Tam (Lockheed Engineering and Sciences Co., Houston, TX.), C. D. Scott, and D. M. Curry *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 371-376 (For primary document see N92-14973 06-02)

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A method of predicting the aerobrake aerothermodynamic environment on the NASA Aeroassist Flight Experiment (AFE) vehicle is described. Results of a three dimensional inviscid nonequilibrium solution are used as input to an axisymmetric nonequilibrium boundary layer program to predict AFE convective heating rates. Inviscid flow field properties are obtained from the Euler option of the Viscous Reacting Flow (VRFLO) code at the boundary layer edge. Heating rates on the AFE surface are generated with the Boundary Layer Integral Matrix Procedure (BLIMP) code for a partially catalytic surface composed of Reusable Surface Insulation (RSI) times. The 1864 kg AFE will fly an aerobraking trajectory, simulating return from geosynchronous Earth orbit, with a 75 km perigee and a 10 km/sec entry velocity. Results of this analysis will provide principal investigators and thermal analysts with aeroheating environments to perform experiment and thermal protection system design. ESA

N92-15021# Technische Hochschule, Aachen (Germany, F.R.). Shock Wave Lab.

HIGH ENTHALPY TESTING IN THE AACHEN (FED. REPUBLIC OF GERMANY) SHOCK TUNNEL TH 2 **c09**

H. Olivier, M. Vetter, and H. Groenig *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 377-384 (For primary document see N92-14973 06-02)

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A simple experimental method is described to determine the free stream conditions and the stagnation enthalpy in a high enthalpy shock tunnel. The main advantage of this method is that it only uses values which are measured within the test section. If measured or computed values of the nozzle reservoir are used to determine the free stream conditions by a nozzle calculation, a lot of uncertainties enter the problem. The performed experiments and the comparisons with numerical results show that the achieved accuracy of the experimental values for high enthalpy conditions is very good. Tests at the same flow conditions have shown that the repeatability margins, typically of the pressure coefficient, are within 5 percent, and for the Stanton number within 10 percent. The error margins are in the same range. ESA

N92-15022# Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Machines Hydrauliques et de Mecanique des Fluides.

NON-EQUILIBRIUM HYPERSONIC FLOW SIMULATIONS USING A COUPLED EULER/BOUNDARY LAYER METHOD

M. L. Sawley and S. Wuethrich *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 387-392 (For primary document see N92-14973 06-02)

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A coupled Euler/boundary layer method to calculate two dimensional hypersonic reentry flows in chemical nonequilibrium is described. The boundary layer equations are applied in the inner (viscous) region and the Euler equations including displacement effects are solved in the outer (inviscid) region. It is shown that, with the inclusion of second order terms, a good matching of the calculated profiles at the interface can be obtained for both the thermodynamic and chemical properties. In addition, it is demonstrated that second order effects can play a major role in determining the values of the surface coefficients. Using the concept of an 'axisymmetric analog', good agreement between the calculated values of the pressure coefficient and Stanton number and those measured along the windward symmetry plane of a double ellipsoid was obtained. ESA

N92-15023# Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Fluidmechnik.

TESTING HIGH ORDER SHOCK-CAPTURING SCHEMES IN 2D SUPER- AND HYPERSONIC FLOWS

T. Hauser, R. Hannappel, and R. Friedrich *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 393-399 (For primary document see N92-14973 06-02)

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A comparison of the MUSCL and implementations of the different Essentially Non-Oscillatory (ENO) schemes for the numerical solution of the time dependent Euler equations is presented. One and two dimensional examples are chosen with features pertinent to the shock turbulence interaction. The suitability of the ENO schemes for blunt body calculations is also shown. The resolution of the different numerical schemes is compared quantitatively by calculating the L(sub 1) norms for the error. The results show the superiority of the ENO schemes over the MUSCL approach in solving problems which contain both shocks and fine structure in smooth regions. On the other hand the MUSCL scheme is faster than the ENO schemes. ESA

N92-15024# Institut de Mecanique de Grenoble (France).
ANALYSIS OF THE EFFECT OF SIDE-WALLS AND CONCOMITANT BOUNDARY LAYERS ON SUPERSONIC 2-D SHEAR LAYER INSTABILITY
Ralf Jens Gathmann *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 401-406 Prepared in cooperation with Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche, France (For primary document see N92-14973 06-02)
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The two dimensional compressible Navier-Stokes equations are solved by direct numerical simulation. The piecewise parabolic method and Roe's linearized Riemann solver are employed to solve the Euler equation accuracy to 4th order in time and in space. The viscous and diffusive terms are treated by a finite volume discretization. The stability of supersonic two dimensional confined spatial shear layers is investigated. This configuration is a model for the mixing of reactants in a scramjet engine. The establishment of wave patterns between the walls and the layer is observed. These patterns can be different in the two streams of the shear layer leading to an asymmetric development of the layer. The influence of laminar boundary layers and their interaction with the wave structures emerging from the shear layer are investigated. ESA

N92-15025# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Div. de Thermophysique.
HYPERSONIC INVISCID FLOW FIELD SIMULATIONS AROUND REENTRY VEHICLES WITH FLAP DEFLECTION
J. L. DaCosta *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 407-412 (For primary document see N92-14973 06-02)
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The study of the reentry phase of spacecrafts like the European Hermes Spaceplane needs the determination of complex three dimensional flows. In order to simulate such hypersonic flows, a multidomain Euler code, named FLU3M, was developed. This code is based upon an explicit/implicit finite volume method of MUSCL type using structured grids. Calculations can be performed either by a time dependent method for subsonic region of the flow, or by space marching procedure for supersonic regions. The hypersonic flowfield around Hermes configurations is investigated. Computations are performed at a freestream Mach number of 10 and 25, for 30 degrees angle of attack and without any sideslip. The simulation is realized under perfect gas or equilibrium air assumption. The aims of the paper are mainly to show the feasibility of three dimensional computations around complex geometries including flap deflection and real ras effects, and to evaluate accurately the flap efficiency. ESA

N92-15026# Vrije Univ., Brussels (Belgium). Dept. of Fluid Dynamics.
A MULTIBLOCK/MULTIGRID CODE FOR THE EFFICIENT SOLUTION OF COMPLEX 3D NAVIER-STOKES FLOWS **c34**
C. Hirsch, C. Lacor, A. Rizzi, P. Eliasson, I. Lindblad, and J. Haeuser (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 415-420 (For primary document see N92-14973 06-02)
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An integrated software package for the simulation of three dimensional Navier-Stokes flows about complex geometries is described. It integrates a grid generator with a solver and a graphical post processing system. It is easily transportable to different computer systems as it is based on standard FORTRAN77 and C++/PHIGS/X Windows for the graphics. In the present contribution, the solver is presented. Emphasis is put on the general framework used to incorporate various schemes based in central and upwind discretization, as well as on the multiblock/multigrid structure of the code and on its internal data management. The applicability of the code is illustrated with three dimensional results of the laminar Navier-Stokes flow in a corner geometry. ESA

N92-15027# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.). Aerodynamics Dept.
COMPUTATIONAL AEROTHERMODYNAMIC METHODS FOR INDUSTRIAL APPLICATIONS TO RE-ENTRY AND HYPERSONIC CRUISE PROBLEMS **c34**
H. Rieger, H. Stock, and B. Wagner *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 421-437 (For primary document see N92-14973 06-02)
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A survey of computational fluid dynamics capabilities and related methodologies which may be useful to support the design of vehicles flying at high supersonic speeds in cruise conditions or passing the hypersonic flight regime during reentry from low Earth orbit, is given. A main objective in hypersonic design is the search for the best compromise between a feasible flight control system and an aerodynamic shape exposed to thermal loads which can be tolerated by the thermal protection system. For the prediction of aerokinetic thermal loads, depending on the flow situation, several alternatives exist which can give reliable answers. Emphasis is placed on Euler and Navier-Stokes methods as well as on more limiting prediction tools like parabolized Navier-Stokes and boundary layer methods. Application of these flow simulation methods to simple as well as to complex configurations of current interest are presented. Activities in the area of transition for hypersonic flows are discussed. ESA

N92-15028# Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Machines Hydrauliques de Mecanique des Fluides.
REAL GAS CALCULATIONS FOR VISCOUS HYPERSONIC FLOWS ON 2-D UNSTRUCTURED MESHES
Penelope Leyland and Jan B. Vos *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 439-446 (For primary document see N92-14973 06-02)
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High Mach number viscous flows are calculated with an unfactorized implicit scheme in time, using a centered approximation for the spatial discretization with unstructured P(sub 1) triangular finite elements. A localized total variation diminishing viscosity matrix term is added in the detached shock region, and this is combined with mesh adaptation by local refinement reduces the spurious oscillations and overshoots which are classical for centered approximations, without affecting the subsonic layers. Equilibrium chemistry effects are taken into account using an equivalent gamma approach. Results of calculations for the flow around a double ellipse are presented. ESA

N92-15029# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL SIMULATION OF THERMOCHEMICAL NON-EQUILIBRIUM VISCOUS FLOWS AROUND REENTRY BODIES **c34**
F. Coquel, V. Joly, C. Marmignon, and C. Flament (Ohio State Univ., Columbus.) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 447-452 Previously announced in IAA as A91-45648 Sponsored by Direction des Recherches, Etudes et Techniques (For primary document see N92-14973 06-02)
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A fully coupled implicit finite volume method is applied to the prediction of axisymmetric and plane equlibrium viscous flows around reentry bodies. The governing equations are discretized using a second order upwind scheme of Harten type for the inviscid fluxes and a space centered scheme for the viscous fluxes. The effects of different physical assumptions and models are investigated. Chemical and thermochemical nonequilibrium calculations around a hyperboloid are compared. The numerical

simulation of the chemical nonequilibrium flow around a double ellipse is presented. Comparisons are made respectively between two chemical models and between two transport phenomenon models. ESA

N92-15030# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

EQUILIBRIUM SOLUTION OF THE EULER AND NAVIER-STOKES EQUATIONS AROUND A DOUBLE ELLIPSOIDAL SHAPE WITH MONO- AND MULTI-BLOCKS INCLUDING REAL GAS EFFECTS, PART 1 **c34**

H. Wong and J. Haeuser *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 453-458 (For primary document see N92-14973 06-02)

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Chemical and thermal equilibrium solutions of the Euler and Navier-Stokes equations around a double ellipsoidal shape at Mach 25 with an angle of attack of 30 degrees are presented. Atmospheric air is assumed to be the continuum medium and is modeled as a real gas. The solutions are obtained by using a finite volume method and the algorithm employs a cell centered fully implicit upwind scheme. Three dimensional mono and multiblock structured grids are employed in order to study the influence of grid topology on the physical solution. Moreover, the grid qualities such as orthogonality, grid point clustering, smoothness, and grid size are also discussed. In particular, the effect of grid adaptation with respect to the physical solution was examined. The aerodynamic coefficients, property contours, and shock standoff distance are presented and compared in each case. ESA

N92-15031# Hyperschall-Technologie-Goettingen (Germany, F.R.).

BEHAVIOUR AND MODELLING OF THE AEROTHERMODYNAMICS OF BALLISTIC ENTRY VEHICLES IN THE HIGH ALTITUDE FLOW REGIMES

Georg Koppenwallner and Dieter Johannsmeier *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 461-467 (For primary document see N92-14973 06-02)

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Special aerodynamic methods, which allow fast aerodynamic performance prediction, are needed for initial design and trajectory calculations. During reentry the flow behavior changes from free molecular through the rarefied regimes to continuum hypersonic. In addition the Mach number decreases from 25 down to low hypersonic. A semiempirical method was adopted to develop formulae for the aerodynamic data prediction. The approach applies the axisymmetric bodies and allows the prediction of lift and drag during the hypersonic entry phase. The bridging between free molecular and continuum flow is based on experiments and on Newtonian and free molecular theory. ESA

N92-15032# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Goettingen (Germany, F.R.). Inst. for Experimental Fluid Mechanics.

APPLICABILITY OF BRIDGING METHODS TO HYPERSONIC RAREFIED FLOW AERODYNAMICS OF REENTRY VEHICLES

Rolf-D. Boettcher *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 469-476 (For primary document see N92-14973 06-02)

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Local bridging methods for transition flow aerodynamics are applied to several shapes including Hermes. Results are compared to wind tunnel data and analyzed with respect to method applicability limits. The conclusion drawn states the necessity of tailoring the methods to the specific configuration under investigation, in close cooperation with wind tunnel experiments. ESA

N92-15033# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

PARALLELIZATION OF A DIRECT SIMULATION MONTE CARLO (DSMC) CODE FOR FLUID DYNAMICS **c34**

Giulio Prisco *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 477-482 (For primary document see N92-14973 06-02)

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Direct Simulation Monte Carlo (DSMC) codes are an essential tool for the computation of aerothermodynamical effects on hypersonic space vehicles. They permit computer simulation of flows to be extended in the rarefied regime, where macroscopic fluid equations do not hold. Being more CPU (Central Processing Unit) intensive than other computational approaches, DSMC codes are an ideal application for parallel machines. The work done in order to modify a DSMC code for parallel/vector execution is described. Short, but, self contained introductions to rarefied gas dynamics, Monte Carlo techniques, and parallel/vector processing are also given. ESA

N92-15034# Laboratoire d'Aerothermique du CNRS, Meudon (France).

DSMC CALCULATION OF A COMPRESSION CORNER FLOW **c34**

Jean-Claude Lengrand *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 483-488 (For primary document see N92-14973 06-02)

(Contract DRET-89-080)

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Direct Simulation Monte Carlo (DSMC) calculations of a compression corner flow were performed for near continuum conditions and moderately rarefied conditions. A parametric study was carried out by varying numerical parameters governing time and space discretization as well as physical parameters governing transitional rotational energy exchange and wall accommodation. Criteria were proposed for the cell size and the time step, in order to make discretization errors negligibly small. As expected, most results are affected by the value of the accommodation coefficient. Even for near continuum conditions, velocity slip and temperature jump at the wall are present as well as a difference between wall normal stress and gas pressure along the wall. ESA

N92-15035# Aerospatiale, Les Mureaux (France). Theoretical Aerodynamic Branch.

TRANSITIONAL FLOWS AROUND RE-ENTRY BODIES

Jean-Francois Pallegoix *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 491-496 Sponsored by Avions Marcel Dassault (For primary document see N92-14973 06-02)

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Flow calculations as solutions of the Boltzmann equation, using the Direct Simulation Monte Carlo (DSMC) method, are presented. The code used was developed in order to calculate flows around complex three dimensional bodies like Hermes. The algorithms for moving molecules and searching for their impact on the wall are based on simple criteria, furthermore the code is fully vectorized. Four calculations on Hermes shape and two other calculations are presented and compared with wind tunnel data, in terms of aerodynamic coefficients or heat transfer. For each calculation, the number of cells and molecules is given, together with storage and Central Processing Unit (CPU) requirements. The discrepancies between calculations and measurements are checked with a simulation of the nonuniformity in the wind tunnel flow. ESA

N92-15036# Stuttgart Univ. (Germany, F.R.). Inst. fuer Raumfahrtsysteme.

NUMERICAL MODELLING OF THE FLOW AROUND A BLUNT BODY IN A PLASMA WIND TUNNEL

P. Hackenberg, M. Auweter-Kurtz, T. H. Gogel, E. W. Messerschmid, and P. C. Sleziona *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 497-502 (For primary document see N92-14973 06-02)
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Under reentry conditions the flow towards a blunt body generates very high temperatures. The development of heat protection materials for reentry vehicles requires qualification tests in plasma wind tunnels. Numerical calculations of the flow around the sample support were performed in order to better understand the experimental results and to relate them to the real flight conditions. Blunt body dissociation and ionization occur in the bow shock region, hence, the gas has to be treated in thermal and chemical nonequilibrium. Program systems are applied by combining different physical fields to one another. As a consequence, the entire problem was divided into three fields: the flow, the chemical, and the electron temperature field. The three dimensional axisymmetric flow field is calculated by an implicit Navier-Stokes solver. The electron temperature is derived from the electron energy equation. For the chemical field the species conservation equations are solved by using source terms received from a suitable two temperature model. The fluid under consideration is nitrogen, consequently five species were concerned. ESA

N92-15037# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE INFLUENCE OF A RETARDING ROCKET ON PARAMETER LIMITS FOR REENTRY TRAJECTORIES **c13**
N. Oren *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 505-507 (For primary document see N92-14973 06-02)
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This simulation enables one to compute the influence of the spinning atmosphere on the recovery devices used in a returning spacecraft: retarding rocket, lifting panels and retarding parachute. The computer simulation determines location, velocity vector, and landing spot. Two articles on the subject were published by the author. The first dealt with the influence of lifting panels on a spacecraft trajectory and the second dealt with the influence of retarding rocket burn time on energy dissipation rate in a spacecraft trajectory. The influence of the retarding rocket burn time on the maximum values along the trajectory of five output parameters is shown. The following items are the five output parameters: maximum rate of heat dissipation; maximum skin temperature; maximum deceleration; and overall trajectory time. ESA

N92-15038# Aerospatiale, Paris (France).
INFLUENCE OF TRAPPED GAS ON WATER HAMMER EFFECTS IN TUBE **c34**
M. Bouton *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 509-513 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

A code was developed for simulating the dynamics of priming, with propellants, in the tube of a propulsion system network. This code takes into account branching, tube dead ends, pressure losses through components, and the recompression of the residual gases at tube ends. The first results showed that pressure peaks due to gas recompression may become higher than pressure peaks caused by liquid bumping against an obstacle. Detailed simulations with FLOW-3D (three dimensional) code showed that, in fact, a complex gas/liquid dynamic interaction occurs at the tube end, which amends the results of pure analytical calculations. The work performed and the results of calculations with TRANSFLUID and the FLOW-3D are presented. ESA

N92-15039*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AEROTHERMODYNAMICS FOR UNITED STATES ADVANCED PROGRAMS
William M. Piland *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 515-533 (For primary document see N92-14973 06-02)
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A series of graphics relating to aerothermodynamics is presented. They following topics are shown: space transportation architecture options and systems, vehicle shapes and design goals, aerothermodynamics (including hypersonic entry), computational fluid dynamics, ground based testing, aeroassist environment, and airbreathing propulsion. ESA

N92-15040# Aerospatiale, Les Mureaux (France). Theoretical Aerodynamic Branch.
COMPUTATION OF AERODYNAMIC COEFFICIENTS ON HERMES-ARIANE5 CONFIGURATION
Christophe Grassin *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 537-542 Sponsored by CNES (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

A numerical prediction of aerothermodynamic coefficients, for the Hermes-Ariane configuration, based on structured-nonstructured Euler solvers is presented. The application is performed for Mach number 1.47 and an angle of attack of 3 degrees. Results are found to compare well with experimental data. ESA

N92-15041# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
GRID IMPACT ON 3D HYPERSONIC FLOWS
J. Haeuser, H. Wong, J. Grawe, and W. Berry *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 543-548 (For primary document see N92-14973 06-02)
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Four, three dimensional (3D), Euler solutions for the Hermes configuration are presented and the impact of the distance of the first layer of points, from the surface, on the pitching moments and lift coefficients is investigated. Results are given. It was shown that for Euler solutions of three dimensional vehicles the computational grid has a strong impact on some of the aerodynamic parameters, which by far exceed the design margins. Therefore, three dimensional solutions have to be checked for grid dependence. This situation is aggravated when a Navier-Stokes solver is used to calculate heat fluxes. Here a special feature of the grid can be used to interactively convert an Euler grid into a Navier-Stokes grid by removing or adding grid lines using a specified distribution to capture the boundary layer. A set of 100,000 points can be deleted/added in a few minutes. ESA

N92-15042# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).
AEROTHERMODYNAMIC CHALLENGES OF THE SAENGER SPACE-TRANSPORTATION SYSTEM
E. H. Hirschel *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 549-558 (For primary document see N92-14973 06-02)
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The two stage to orbit Saenger space transportation system is considered. The technology development concentrates first on the needs of the lower stage. Its requirements for aerothermodynamics and propulsion integration are sketched. The aerothermodynamic design challenge is discussed. The design tools and the design methodology are reviewed. The validation of both the computational and the experimental methods, as well as the test of vehicle components, like the inlet and control surfaces, make the

experimental vehicle Hytex mandatory. Contents and workplan of the technology program 'Aerothermodynamics and propulsion integration' are laid out. Selected results from the current work are presented. ESA

N92-15043# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
REVIEW OF THE EUROPEAN HYPERSONIC WIND TUNNEL PERFORMANCE AND SIMULATION REQUIREMENTS c09
J. Muylaert, T. Voiron, P. Sagnier, D. Lourme, O. Papirnyk, K. Hannemann, K. Buetefisch, and Georg Koppenwallner (Hyperschall-Technologie-Goettingen, Germany, F.R.) *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 559-574
(For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

Hypersonic wind tunnel testing is required in many stages during the development of an aerospace vehicle. In order to reproduce the physical phenomena in a scale experiment similarity parameters must be considered. The simultaneous duplication of all simulation parameters is not possible in ground based facilities. The facilities can be grouped as follows: the classical hypersonic wind tunnels; the high enthalpy facilities; and the low density wind tunnels. A review of all the facilities within the Hermes project is given. Their simulation capabilities, flow quality, and measurement techniques are outlined. In addition, two major new high enthalpy facilities in Europe, the F4 and the High Enthalpy wind tunnel Gottingen (HEG) are presented. In order to improve the level of understanding in hypersonic testing, a standard model is recommended. ESA

N92-15044# Naval Postgraduate School, Monterey, CA.
OSCILLATING-FLOW WIND TUNNEL STUDIES FOR A CIRCULATION CONTROL CIRCULAR CYLINDER M.S. Thesis
George P. Christopoulos Mar. 1991 110 p
(AD-A242459) Avail: NTIS HC/MF A06 CSCL 01/1

A two-dimensional circulation control (4.25-in. diam. x 24-in. span) model was designed for installation in the Naval Postgraduate School oscillating flow, low speed wind tunnel. An adjustable, tangential blowing slot was included in the design to provide circulation control capability using the Coanda flow effect aft of the spanwise slot. Orifice locations were defined for obtaining surface static pressures which could be subsequently processed to yield sectional lift and drag coefficients. Pressure system calibrations were also made to determine the dynamic transfer function from a simulation of the model's static pressure orifice when connected to the pressure transducer. Similar transfer functions were determined for a static pressure probe. The existing data acquisition system was used to process the sampled digital data sequence. Clear-tunnel flow calibrations were performed in the (2'x2'x18.6' long) test section at a mid-length test station using a hot-wire and the calibrated static pressure probe. An oscillating velocity was superimposed upon a mean free stream motion using an existing rotating mechanism of 4 synchronized shutters at the end of the test section. Analytic estimates of both static pressure and velocity perturbations correlated well with experimental results for a frequency range of 14-40 Hz with a fixed value of shutter blockage. GRA

N92-15045# Naval Postgraduate School, Monterey, CA.
PRELIMINARY INVESTIGATION OF THE SHOCK-BOUNDARY LAYER INTERACTION IN A SIMULATED FAN PASSAGE M.S. Thesis
Christopher C. Collins Mar. 1991 129 p
(AD-A242656) Avail: NTIS HC/MF A07 CSCL 20/4

A two dimensional, two passage simulation of the relative flow through a transonic fan at M = 1.4 was designed with a view to providing an apparatus in which to assess the effectiveness of passive vortex generator techniques in alleviating shock-boundary layer interaction effects. The design of the model and the results of six test runs in the transonic cascade blowdown wind tunnel are described. Schlieren photographs of the shock structure were obtained at back pressures lower than the design value. The back-pressure control valve was identified as being critical to completing the experimental simulation. The flow through the cascade geometry was computed at design pressure ratio using an Euler code. Modifications to the grid are recommended before thin-layer Navier-Stokes calculations are performed. GRA

N92-15046*# Analytical Services and Materials, Inc., Hampton, VA.
ON THE WALL-NORMAL VELOCITY OF THE COMPRESSIBLE BOUNDARY-LAYER EQUATIONS
C. David Pruett Washington NASA Dec. 1991 42 p
(Contract NAS1-18599)
(NASA-CR-4419; NAS 1.26:4419) Avail: NTIS HC/MF A03 CSCL 01A

Numerical methods for the compressible boundary-layer equations are facilitated by transformation from the physical (x,y) plane to a computational (xi,eta) plane in which the evolution of the flow is 'slow' in the time-like xi direction. The commonly used Levy-Lees transformation results in a computationally well-behaved problem for a wide class of non-similar boundary-layer flows, but it complicates interpretation of the solution in physical space. Specifically, the transformation is inherently nonlinear, and the physical wall-normal velocity is transformed out of the problem and is not readily recovered. In light of recent research which shows mean-flow non-parallelism to significantly influence the stability of high-speed compressible flows, the contribution of the wall-normal velocity in the analysis of stability should not be routinely neglected. Conventional methods extract the wall-normal velocity in physical space from the continuity equation, using finite-difference techniques and interpolation procedures. The present spectrally-accurate method extracts the wall-normal velocity directly from the transformation itself, without interpolation, leaving the continuity equation free as a check on the quality of the solution. The present method for recovering wall-normal velocity, when used in conjunction with a highly-accurate spectral collocation method for solving the compressible boundary-layer equations, results in a discrete solution which is extraordinarily smooth and accurate, and which satisfies the continuity equation nearly to machine precision. These qualities make the method well suited to the computation of the non-parallel mean flows needed by spatial direct numerical simulations (DNS) and parabolized stability equation (PSE) approaches to the analysis of stability. Author

N92-15047*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
PROGRESS WITH MULTIGRID SCHEMES FOR HYPERSONIC FLOW PROBLEMS Final Report
R. Radespiel (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick, Germany, F.R.) and R. C. Swanson Dec. 1991 43 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189579; ICASE-91-89; NAS 1.26:189579) Avail: NTIS HC/MF A03 CSCL 01A

Several multigrid schemes are considered for the numerical computation of viscous hypersonic flows. For each scheme, the basic solution algorithm uses upwind spatial discretization with explicit multistage time stepping. Two level versions of the various multigrid algorithms are applied to the two dimensional advection equation, and Fourier analysis is used to determine their damping properties. The capabilities of the multigrid methods are assessed by solving three different hypersonic flow problems. Some new multigrid schemes based on semicoarsening strategies are shown to be quite effective in relieving the stiffness caused by the high aspect ratio cells required to resolve high Reynolds number flows. These schemes exhibit good convergence rates for Reynolds numbers up to 200 x 10(exp 6) and Mach numbers up to 25. Author

N92-15048*# Eloret Corp., Sunnyvale, CA.
EXPERIMENTAL RESEARCH OF THE AERODYNAMICS OF NOZZLES AND PLUMES AT HYPERSONIC SPEEDS Final Technical Report, 1 Aug. 1988 - 31 Dec. 1991

Earl R. Keener 7 Jan. 1992 42 p
(Contract NCC2-553)
(NASA-CR-187316; NAS 1.26:187316) Avail: NTIS HC/MF A03 CSCL 01A

The purpose was to experimentally characterize the flow field created by the interaction of a single expansion ramp nozzle (SERN) flow with a hypersonic external stream. Data were obtained from a generic nozzle/afterbody model in the 3.5 Foot Hypersonic Wind Tunnel of the NASA Ames Research Center. The model design and test planning were performed in close cooperation with members of the National Aero-Space Plane (NASP) computational fluid dynamics (SFD) team, so that the measurements could be used in CFD code validation studies. Presented here is a description of the experiment, the extent of the measurements obtained, and the experimental results.

Author

N92-15049*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

THE BENCHMARK AEROELASTIC MODELS PROGRAM: DESCRIPTION AND HIGHLIGHTS OF INITIAL RESULTS

Robert M. Bennett, Clinton V. Eckstrom, Jose A. Rivera, Jr., Bryan E. Dansberry, Moses G. Farmer, and Michael H. Durham Dec. 1991 13 p Presented at the AGARD Structures and Materials Panel Specialists' Meeting on Transonic Unsteady Aerodynamics and Aeroelasticity, San Diego, CA, 9-11 Oct. 1991
(NASA-TM-104180; NAS 1.15:104180; AGARD-Paper-25) Avail: NTIS HC/MF A03 CSCL 01A

An experimental effort was implemented in aeroelasticity called the Benchmark Models Program. The primary purpose of this program is to provide the necessary data to evaluate computational fluid dynamic codes for aeroelastic analysis. It also focuses on increasing the understanding of the physics of unsteady flows and providing data for empirical design. An overview is given of this program and some results obtained in the initial tests are highlighted. The tests that were completed include measurement of unsteady pressures during flutter of rigid wing with a NACA 0012 airfoil section and dynamic response measurements of a flexible rectangular wing with a thick circular arc airfoil undergoing shock boundary layer oscillations. Author

N92-15050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

A FAST IMPLICIT UPWIND SOLUTION ALGORITHM FOR THREE-DIMENSIONAL UNSTRUCTURED DYNAMIC MESHES

John T. Batina Dec. 1991 8 p Presented at the AIAA 30th Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992
(NASA-TM-104186; NAS 1.15:104186) Avail: NTIS HC/MF A02 CSCL 01A

A fast implicit upwind algorithm for the solution of the time-dependent Euler equations is presented for aerodynamic analysis involving unstructured dynamic meshes. The spatial discretization of the scheme is based on the upwind approach of Roe, referred to as flux-difference splitting (FDS). The FDS approach is naturally dissipative and captures shock waves and contact discontinuities sharply. The temporal discretization of the scheme involves an implicit time-integration using a two-sweep Gauss-Seidel relaxation procedure. The procedure is computationally efficient for either steady or unsteady flow problems. A detailed description is given of the implicit upwind solution algorithm along with results which assess the capability. The results are presented for the NACA 0012 airfoil and for the Boeing 747 aircraft. The 747 geometry includes the fuselage, wing, horizontal and vertical tails, under-wing pylons, and flow-through engine nacelles. Euler solutions for the 747 aircraft on an unstructured tetrahedral mesh containing approximately 100,000 cells were obtained to engineering accuracy in less than one hour CPU time on a Cray-2 computer. Author

N92-15051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

RESULTS OF AN ICING TEST ON A NACA 0012 AIRFOIL IN THE NASA LEWIS ICING RESEARCH TUNNEL

Jaiwon Shin and Thomas H. Bond 1992 21 p Presented at the 30th Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992; sponsored by AIAA
(NASA-TM-105374; E-6761; NAS 1.15:105374; AIAA-92-0647)
Avail: NTIS HC/MF A03 CSCL 01A

Tests were conducted in the Icing Research Tunnel (IRT) at the NASA Lewis Research Center to document the current capability of the IRT, focused mainly on the repeatability of the ice shape over a range of icing conditions. Measurements of drag increase due to the ice accretion were also made to document the repeatability of drag. Surface temperatures of the model were obtained to show the effects of latent-heat release by the freezing droplets and heat transfer through the ice layer. The repeatability of the ice shape was very good at low temperatures, but only fair at near freezing temperatures. In general, drag data shows good repeatability. Author

N92-15052*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

A TURBULENCE MODEL FOR ICED AIRFOILS AND ITS VALIDATION

Jaiwon Shin, Hsun H. Chen, and Tuncer Cebeci (California State Univ., Long Beach.) 1992 17 p Presented at the 30th Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992; sponsored by AIAA
(NASA-TM-105373; E-6760; NAS 1.15:105373; AIAA-92-0417)
Avail: NTIS HC/MF A03 CSCL 01A

A turbulence model based on the extension of the algebraic eddy viscosity formulation of Cebeci and Smith developed for two dimensional flows over smooth and rough surfaces is described for iced airfoils and validated for computed ice shapes obtained for a range of total temperatures varying from 28 to -15 F. The validation is made with an interactive boundary layer method which uses a panel method to compute the inviscid flow and an inverse finite difference boundary layer method to compute the viscous flow. The interaction between inviscid and viscous flows is established by the use of the Hilbert integral. The calculated drag coefficients compare well with recent experimental data taken at the NASA-Lewis Icing Research Tunnel (IRT) and show that, in general, the drag increase due to ice accretion can be predicted well and efficiently. Author

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N92-15053# Dayton Univ. Research Inst., OH. Structural Integrity Div.

STUDY OF THE ENGINE BIRD INGESTION EXPERIENCE OF THE BOEING 737 AIRCRAFT Final Report, Oct. 1986 - Sep. 1989

Peter W. Hovey, Donald A. Skinn, and Joseph J. Wilson Oct. 1991 196 p
(Contract DTFA03-88-C-00024)
(DOT/FAA/CT-89/16; DOT/FAA/CT-89/29; DOT/FAA/CT-90/28; UDR-TR-90-108) Avail: NTIS HC/MF A09

The objective of this report is to determine the relationship of bird weight, number of birds ingested, geographic location, season, time of day, phase of flight, and engine type to the frequency of bird ingestion events and the extent of engine damage, if any, resulting from the ingested birds. The statistical analysis of reported bird ingestions experienced by commercial B737 airplanes worldwide over a 3-year reporting period is used to summarize the service threat and level of engine damage experienced by

these airplanes. The findings of the analysis will be helpful in defining minimum engine design requirements for resistance to damage as a result of bird ingestions. Moreover, this study will provide a comparison between the experience of a contemporary high bypass ratio turbofan engine (CFM56) and an older low bypass ratio turbofan engine with a smaller inlet (JT8D) exposed to similar aircraft-bird ingestion environments. Author

N92-15054# Cranfield Inst. of Tech., Bedford (England). Applied Psychology Unit.
PASSENGER KNOWLEDGE OF AIRLINE SAFETY INFORMATION
P. J. Fennell, J. R. Harris, and H. C. Muir Nov. 1988 32 p
(Cranfield-Aero-9111; ISBN-1-871564-31-X; ETN-92-90704)
Avail: NTIS HC/MF A03; Coll. of Aeronautics, Cranfield Inst. of Technology, Cranfield, Bedford MK43 0AL, England, HC 8 sterling pounds

Five hundred passengers participated in an investigation into their knowledge of the preflight briefing and the safety card information. A tendency was observed for passengers to overestimate their ability to recall some aspects of the preflight briefing and safety card. Males had a higher score on questions regarding safety information than females, although this difference may be due to the fact that the majority of business passengers are male. Some aspects of the preflight briefing and the safety card information were identified as requiring clarification in order to ensure that all passengers are to utilize the information correctly in an emergency. 79.9 percent of passengers pay attention to the briefing on most flights, and 59.7 percent read the card on most flights. It is suggested that these percentages are likely to overestimate the actual percentage of passengers who pay attention. Frequent passengers reported paying the least attention to briefings and safety cards, though they also had more knowledge of safety information than less frequent passengers. To ensure the safety of all passengers, it is important that both frequent and infrequent passengers are motivated to pay more attention to safety information and to increase their knowledge. Suggestions made by passengers regarding methods which they believe could increase attention are included. ESA

N92-15055# National Transportation Safety Board, Washington, DC.
AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORT: MIDAIR COLLISION INVOLVING LYCOMING AIR SERVICES PIPER AEROSTAR PA-60 AND SUN COMPANY AVIATION DEPARTMENT BELL 412, MERION, PENNSYLVANIA, APRIL 4, 1991
17 Sep. 1991 29 p
(PB91-910407; NTSB/AAR-91/01/SUM) Avail: NTIS HC/MF A03 CSCL 01C

An explanation is presented for the midair collision involving a Lycoming Air Services Piper Aerostar PA-60 and a Sun Company Aviation Dept. Bell 412. The safety issues discussed include pilot judgement, the training and checking of flight crews, the adequacy of the PA-60 flight manual, and FAA surveillance of the carrier. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N92-15056# Sandia National Labs., Albuquerque, NM.
TERRAIN REFERENCED NAVIGATION FOR CRUISE MISSILES
J. Hollowell 1991 44 p Presented at the 1991 Cruise Missiles Technology Symposium (CMTS), Laurel, MD, 7 Nov. 1991
(Contract DE-AC04-76DP-00789)
(DE92-000228; SAND-91-2189C; CONF-9111100-1) Avail: NTIS HC/MF A03

Global Positioning System (GPS) receivers provide absolute position accuracy that is more than adequate for enroute navigation on cruise missiles. However, their vulnerability to outside threats provides the impetus for considering other navigation aids. The Terrain Contour Matching (TERCOM) Terrain Referenced Navigation (TRN) system provides self-contained navigation for existing cruise missiles. One significant problem with the existing TERCOM system is its stringent mission planning requirements. The digitized maps used by the system must be carefully selected and checked prior to the mission. Additionally, route planning is severely constrained since the missile must fly over the preselected maps. Defense Mapping Agency (DMA) Level 1 Digital Terrain Elevation Data (DTED) is available for a large portion of the Earth's landmass. Use of this database may drastically reduce TRN mission planning requirements since the map selection process is avoided and route planning becomes much more flexible. Two tasks were performed in support of this goal. First, a large portion of the existing database of Level 1 DTED was screened based on certain terrain parameters that provide some a priori indication of how a TRN system would perform over a given area of the Earth. Secondly, flight tests were conducted to determine the actual performance of a TRN algorithm over a representative sample of Level 1 DTED. The results and conclusions from these two tasks follow. DOE

N92-15057# Naval Postgraduate School, Monterey, CA.
ROBUST PATH TRACKING OF AUTONOMOUS UNDERWATER VEHICLES USING SLIDING MODES M.S. Thesis
Steven R. Chism Dec. 1990 158 p
(AD-A242558) Avail: NTIS HC/MF A08 CSCL 13/10

Accurate track keeping of autonomous underwater vehicles is necessary for the autonomous navigation of a vehicle through confined spaces, and in the presence of obstacles and cross-current environments. Uncertainties in the force coefficients and environmental disturbances, as well as the required accuracy lead to the need for a robust sliding mode control for successful vehicle operations. This thesis investigates the use of a cross track error guidance law with a sliding mode compensator and presents results based on computer simulations using a nonlinear dynamic model of the Swimmer Delivery Vehicle. Steady state errors and stability requirements are evaluated analytically for a given current speed and direction, and are confirmed through numerical integrations. The use of integral control and disturbance estimation and compensation methods are developed in order to achieve the desired steady state accuracy. A leading track control monitoring technique is used to eliminate track overshoot during turning and reduce the rudder activity. Finally, the effects of measurement noise are evaluated and guidelines are developed for suppressing them. GRA

N92-15058# Mitre Corp., Bedford, MA.
THE PROBLEM OF MULTIPLE SOLUTIONS IN AREA NAVIGATION AND COMPUTED CENTERLINE OPERATIONS WITH THE MICROWAVE LANDING SYSTEM Final Report
Frederick D. Powell Aug. 1991 77 p
(Contract F19628-89-C-0001)
(AD-A242757; MTR-11023; ESD-TR-91-213) Avail: NTIS HC/MF A05 CSCL 17/7

In normal geometries of siting of the ground units, the Microwave Landing System (MLS) observations in the avionics of azimuth and elevation angles plus slant range from a Distance Measuring Equipment (DME) transponder yield a unique solution for the aircraft location. However, for some unconventional geometries of the ground units in a very few, preexisting installations, these observations can be consistent with two solutions for aircraft location within the MLS coverage volume. It appears that the basic MLS concept has not dealt with this multiple solutions situation, which is possible within the present international agreements. This report shows that the MLS avionics position reconstruction algorithms, which determine the aircraft location in

Cartesian coordinates and are essential in area navigation, computed centerline approach, and ground operations, such as deceleration and turnoff, cannot tell which of the two solutions is true and which is false from internal data. The problem can be avoided by new constraints on the permitted sites for the MLS ground units, by restrictions on the aircraft flight paths, or by Kalman filters or equivalents in the avionics. These constraints, restrictions, and filters are defined. GRA

N92-15059# Northwest Research Associates, Inc., Bellevue, WA.
PRELIMINARY INVESTIGATION OF LONGITUDINAL DIFFERENCES IN TEC AND SCINTILLATION AT TRANSITION LATITUDES Final Report, 3 Jun. 1989 - 31 Jan. 1991
E. J. Fremouw, C. C. Andreasen, M. J. Klein, and J. M. Lansinger 4 Apr. 1991 24 p
(Contract F19628-89-C-0122)
(AD-A242811; NWRA-CR-91-R068; PL-TR-91-2107) Avail: NTIS HC/MF A03 CSCL 04/1

The intensity of the two L-band signals transmitted from satellites of the Global Positioning System and the differential carrier phase (DCP) and differential group delay (DGD) between them have been recorded at two locations on opposite sides of the North Atlantic--Hanscom AFB, MA, and Lerwick, Shetland Islands, UK. Recordings, at 20 samples per sec, were initiated in September 1989, with some 6790 hours of data being collected at Hanscom and some 3700 hours at Lerwick by the end of November 1990. The DCP records, calibrated by means of DGD, have been converted to measurements of ionospheric total electron content (TEC), with the intensity records being used to identify times of radiowave scintillation produced by relative fine structure therein. Substantially greater occurrence of sharp TEC gradients and scintillation was documented at Lerwick than at Hanscom, with clear evidence of geomagnetic control. The two stations are well separated in longitude, and their fields of view overlap substantially in latitude, although centered some five degrees apart geomagnetically. The large difference in TEC/scintillation activity may result from the latter difference or from other factors. Samples of the activity are provided herein, and recommendations are made for analyses designed to isolate the likely factors. GRA

N92-15060*# Douglas Aircraft Co., Inc., Long Beach, CA.
MICROWAVE LANDING SYSTEM AUTOLAND SYSTEM ANALYSIS Final Report
J. B. Feather and B. K. Craven Dec. 1991 62 p
(Contract NAS1-18028)
(NASA-CR-189551; NAS 1.26:189551; C1-1X2-TN-393) Avail: NTIS HC/MF A04 CSCL 17G

The objective was to investigate the ability of present day aircraft equipped with automatic flight control systems to fly advanced Microwave Landing Systems (MLS) approaches. The tactical approach used to achieve this objective included reviewing the design and autoland operation of the MD-80 aircraft, simulating the MLS approaches using a batch computer program, and assessing the performance of the autoland system from computer generated data. The results showed changes were required to present Instrument Landing System (ILS) procedures to accommodate the new MLS curved paths. It was also shown that in some cases, changes to the digital flight guidance systems would be required so that an autoland could be performed. Author

N92-15061# Systems Control Technology, Inc., Arlington, VA.
ROTORCRAFT LOW ALTITUDE IFR BENEFIT/COST ANALYSIS: OPERATIONS ANALYSIS Interim Report No. 2
Robert K. Anoll, Len D. Dzamba, Linda J. LaBelle, Randahl N. Lindgren, Robert B. Newman, and Deborah J. Peisen Dec. 1991 192 p
(Contract DTFA01-87-C-00014)
(SCT-90RR-44; DOT/FAA/DS-89/10) Avail: NTIS HC/MF A09

The Rotorcraft Master Plan advocates the establishment of additional communications, navigation, and surveillance (CNS) facilities, as well as the analysis and development of systems to satisfy the increasing demand for widespread instrument flight rules (IFR) rotorcraft operations within the National Airspace System (NAS). The objective of this study is to determine if there is an economic basis for improvement of these low altitude IFR services within the NAS in order to better support rotorcraft IFR operations. The findings of this study will aid FAA decisionmaking in that regard. In view of prior implementation decisions on Loran-C, the emphasis in this effort is on communications, surveillance, procedural changes, and avionics. This report is one of a series of three reports that address rotorcraft low altitude IFR benefit/cost analysis. This second interim report defines operational requirements and constraints for selected rotorcraft missions. A candidate list of 50 sites around the country, selected for their potential to benefit from increased low altitude IFR services, is presented. Radar and communications coverages in those areas are then identified. CNS improvements to be provided by implementation of the NAS plan, relevant FAA policies, air traffic control (ATC) procedures, and avionics improvements are analyzed for their potential to benefit low altitude rotorcraft IFR operations. A benefit/cost methodology to determine where the most benefits would accrue from improvements in rotorcraft low altitude IFR services or changes in ATC procedures is presented. Author

N92-15062*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A PC-BASED BUS MONITOR PROGRAM FOR USE WITH THE TRANSPORT SYSTEMS RESEARCH VEHICLE RS-232 COMMUNICATION INTERFACES
Wesley C. Easley Dec. 1991 43 p
(NASA-TM-104175; NAS 1.15:104175) Avail: NTIS HC/MF A03 CSCL 17G

Experiment critical use of RS-232 data busses in the Transport Systems Research Vehicle (TSRV) operated by the Advanced Transport Operating Systems Program Office at the NASA Langley Research Center has recently increased. Each application utilizes a number of nonidentical computer and peripheral configurations and requires task specific software development. To aid these development tasks, an IBM PC-based RS-232 bus monitoring system was produced. It can simultaneously monitor two communication ports of a PC or clone, including the nonstandard bus expansion of the TSRV Grid laptop computers. Display occurs in a separate window for each port's input with binary display being selectable. A number of other features including binary log files, screen capture to files, and a full range of communication parameters are provided. Author

N92-15063*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EXPANDED SERIAL COMMUNICATION CAPABILITY FOR THE TRANSPORT SYSTEMS RESEARCH VEHICLE LAPTOP COMPUTERS
Wesley C. Easley Dec. 1991 34 p
(NASA-TM-104176; NAS 1.15:104176) Avail: NTIS HC/MF A03 CSCL 17G

A recent upgrade of the Transport Systems Research Vehicle (TSRV) operated by the Advanced Transport Operating Systems Program Office at the NASA Langley Research Center included installation of a number of Grid 1500 series laptop computers. Each unit is a 80386-based IBM PC clone. RS-232 data busses are needed for TSRV flight research programs, and it has been advantageous to extend the application of the Grids in this area. Use was made of the expansion features of the Grid internal bus to add a user programmable serial communication channel. Software to allow use of the Grid bus expansion has been written and placed in a Turbo C library for incorporation into applications programs in a transparent manner via function calls. Port setup; interrupt-driven, two-way data transfer; and software flow control are built into the library functions. Author

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles see *85 Urban Technology and Transportation.*

N92-15064# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

LOCALIZATION OF THE CAUSES OF THE DIFFERENCES BETWEEN MEASURED AND CALCULATED MODAL PARAMETERS

A. deBoer and M. H. M. Ellenbroek (Fokker Space and Systems, Amsterdam, Netherlands) 4 May 1990 21 p Presented at Dutch National Applied Mechanics Congress, Rolduc Kerkrade, Netherlands, 2-4 Apr. 1990

(NLR-TP-90123-U; ETN-92-90431) Copyright Avail: NTIS HC/MF A03

In the design phase, finite element models are often used to calculate the dynamic behavior of a structure. Before the model can be applied by other disciplines (such as attitude control), it must be validated. This means that the measured and calculated modal parameters must be compared. If differences are found, the causes must be localized. A number of localization methods were evaluated. The methods were programmed and applied for different structures. The results of this investigation are presented. The conclusion is that no single method gives reliable results for a wide class of problems. The best way is to use different methods next to each other and to base conclusions on engineering judgement of the results obtained with the different methods. ESA

N92-15065# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

MONITORING LOAD EXPERIENCE OF INDIVIDUAL AIRCRAFT

J. B. deJonge 3 Sep. 1990 12 p Presented at 17th ICAS Congress, Stockholm, Sweden, Sep. 1990

(NLR-TP-90084-U; ETN-92-90432) Avail: NTIS HC/MF A03

The actual service load experience of aircraft may differ appreciably from design assumptions. The necessity to monitor service loads is generally recognized now for military aircraft. A general review of the overall life management procedure commonly used today is given. Specific elements in this procedure are discussed in some detail. Specific attention is paid to the amount of scatter in severity between different flights and the required sample sizes of flight load measurements for obtaining reliable average load spectrum data. Possible causes for variation in load experience between different aircraft flying the same duty are analyzed. It is concluded that Individual Aircraft Tracking (IAT), if necessary at all, can usually be adequately accomplished by administrative means, indicated as Usage Monitoring. ESA

N92-15066# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).

DEVELOPMENT AND EVALUATION OF A FINITE ELEMENT MODEL FOR A FIBER COMPOSITE HELICOPTER FUSELAGE [ENTWICKLUNG UND AUSWERTUNG EINES FINITE-ELEMENTE-MODELLS EINER HUBSCHRAUBERZELLE IN FASERVERBUNDBAUWEISE]

Hans Barnerssoi 10 Oct. 1990 11 p In GERMAN; ENGLISH summary Presented at the I-DEAS/CAEDS User's Conference, Schluchsee, Fed. Republic of Germany, 10-12 Oct. 1990

(MBB-UD-0584-90-PUB; ETN-92-90612) Avail: NTIS HC/MF A03

Taking the German-French helicopter TIGER as an example, the use of the laminate module at pre- and post-processing is emphasized. The advantages of such modules are shown. The three dimensional surface program CARTA is described. The model is composed of points, splines, and curves. The process of laminate construction is explained. The computational process is described. It is shown that in the present version, girder elements in fiber composites cannot be idealized. A criterion of failure is introduced for fiber plates and girder elements and for local instability of sandwich elements. ESA

N92-15067# Naval Postgraduate School, Monterey, CA.

FLIGHT OPERATIONS FOR HIGHER HARMONIC CONTROL RESEARCH M.S. Thesis

James J. McGovern Mar. 1991 63 p

(AD-A242478) Avail: NTIS HC/MF A04 CSCL 20/11

The Department of Aeronautics and Astronautics at the Naval Postgraduate School (NPS) is interested in extending the useful life of Naval helicopters. Recognizing the need to reduce vibrations caused by aerodynamic loads on the rotor system, a Higher Harmonic Control (HHC) research effort has begun. The test vehicle of the HHC system is a Remotely Piloted Helicopter (RPH). This thesis contains an overview of the NPS HHC research effort including basic helicopter dynamics, HHC theory, and establishes research milestones. An RPH flight operations program was developed that included the first flights of two out of three RPH's being used in the research effort, identification of data and data acquisition requirements, and initial hover vibration tests. The vibration tests produced data of limited value. The two bladed RPH tested appears to produce peak accelerations at roughly twice the main rotor speed. This indicates that like a full scale helicopter, the largest vibrations do enter the airframe through the rotor system and are not a result of engine vibrations. Hence, RPH's are suitable for HHC research. This effort completed one portion of the long term HHC research and can lead to the practical and safe testing of a fully functioning HHC system. GRA

N92-15068# Naval Postgraduate School, Monterey, CA.

STRUCTURAL CONSIDERATIONS FOR AIRCRAFT PAYLOAD MODIFICATION: P-3C ZERO FUEL WEIGHT INCREASE M.S. Thesis

Steven D. Culpepper Mar. 1991 76 p

(AD-A242690) Avail: NTIS HC/MF A05 CSCL 01/3

The Navy is considering the feasibility of increasing the patrol aircraft P-3C zero fuel weight enabling avionics and payload growth. This analysis examines the consequences to the structural requirements of the center section wing box. Two solutions to the structures field equations are investigated: a simplified hand solution for preliminary feasibility calculations and a more precise solution for design analysis. Together, the solutions provide a necessary check for the results. The simplified solution employs the Euler-Bernoulli assumption which generates a set of integrals expressed in terms of the assumed displacements. These integrals, when combined with simplified geometric shapes and symmetry, ultimately produce a decoupled matrix solution. The precise solution uses a PC based finite element method which simultaneously solves the field equations for basic elements to be linked together with the appropriate boundary conditions. For the current 135,000 pound gross weight 1 g load condition, the internal stresses calculated by finite element are in accord with those by simplified hand calculation. Extensions from this modeling will generate design criterion for the target 95,000 pound zero fuel weight aircraft as well as alternate flight or taxi conditions. GRA

N92-15069# Wright Lab., Wright-Patterson AFB, OH.

EVOLUTION AND DEVELOPMENT OF HYPERSONIC CONFIGURATIONS 1958-1990 Final Report, Jul. 1990 - Mar. 1991

Alfred C. Draper and Thomas R. Sieron Sep. 1991 128 p (AF Proj. 2404)

(AD-A242768; WL-TR-91-3067) Avail: NTIS HC/MF A07 CSCL 01/3

This report traces the activities of the Flight Dynamics Laboratory in hypersonic configuration research. Early efforts concentrated on simple configurations and progressed to more sophisticated lifting body point designs as analysis and design techniques became available. Several flight technology demonstration programs pioneered the exploitation of this new challenging flight regime and provided an extensive data base for the development of the Space Shuttle. Hypersonic air-breathing

cruise vehicles are shown to be dominated by inlet and nozzles integration with the airframe. A list of lessons learned is compiled to provide a useful reference for the designer in the early formulation of configurations concepts. GRA

N92-15070*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
FLUTTER SUPPRESSION VIA PIEZOELECTRIC ACTUATION
Jennifer Heeg Sep. 1991 17 p
(NASA-TM-104120; NAS 1.15:104120) Avail: NTIS HC/MF A03 CSCL 01C

Experimental flutter results obtained from wind tunnel tests of a two degree of freedom wind tunnel model are presented for the open and closed loop systems. The wind tunnel model is a two degree of freedom system which is actuated by piezoelectric plates configured as bimorphs. The model design was based on finite element structural analyses and flutter analyses. A control law was designed based on a discrete system model; gain feedback of strain measurements was utilized in the control task. The results show a 21 pct. increase in the flutter speed. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N92-15071# Universal Technology Corp., Dayton, OH.
DOMESTIC AND FOREIGN TRADE POSITION OF THE UNITED STATES AIRCRAFT TURBINE ENGINE INDUSTRY. TASK SIX: SHORT-TERM GAS TURBINE PROPULSION ANALYSIS AND ASSESSMENT Interim Report, Sep. 1989 - Aug. 1990
H. I. Bush and Randolph W. Spratt Jun. 1991 181 p
(Contract F33615-88-C-2823)
(AD-A242646; WL-TR-91-2066) Avail: NTIS HC/MF A09 CSCL 21/5

U.S. aircraft engines and parts imports/exports are traced through the 70's and 80's, showing a trend that, if continued, will position the U.S. as a net importer of engines and parts by the turn of the century. New engine production between 1970 and 1988 is traced and comparisons made between the U.S. and other western world countries. The U.S. share in engine production eroded from 84 percent in 1970 to 62 percent in 1988, while the European Community (E.C.) more than doubled its share (15 to 32 percent). Changes in market character are reviewed (military/civil segments and coproduction growth). The machine tool industry's rise in Japan and its collapse in the U.S. is reviewed to identify conditions that also may characterize the U.S. engine industry. The U.S., E.C., and Japanese aircraft engine industries are briefly compared to highlight causes for the U.S. erosion and E.C. gain. Conclusions are drawn regarding the U.S. aircraft engine industry's trade position, and recommendations are offered for activity to assure that U.S. engines are produced with superior quality to lower cost than can be achieved by any of its international competitors for the foreseeable future. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N92-15072# Technische Univ., Brunswick (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik.
PROJECT OF AN ADAPTIVE MULTIAXIAL AUTOPILOT WITH LEARNING PILOT CONTROL Ph.D. Thesis [ENTWURF EINES SELBSTEINSTELLENDEN MEHRACHSIGEN FLUGREGLERS MIT LERNENDER VORSTEUERUNG]
Ulrich Lindemann 1991 116 p In GERMAN
(ETN-92-90592) Avail: NTIS HC/MF A06

The autopilot was implemented in the form of several computing programs in the digital computer of research aircraft. It was successfully tested in flight trial. The coefficients of a discrete model transfer function were identified from the dynamic behavior of the aircraft. The identification assessed the relation between the autocorrelation of the test signal and the cross correlation of test signal and aircraft behavior. This process proved efficient. A universal applicable software package was developed during the flight trial of the autopilot, which allowed for the testing of control algorithms in real time conditions in the aircraft. ESA

N92-15073# Aeronautical Research Labs., Melbourne (Australia).
F/A-18 STABILATOR: EQUIVALENT SET OF POINT FORCES REQUIRED FOR PNEUMATIC BAG LOAD CASE SIMULATION
Simon C. DArcy Oct. 1990 44 p
(AD-A242637; ARL-STRUC-TM-571; DODA-AR-006-123) Avail: NTIS HC/MF A03 CSCL 01/3

In preparation for a fatigue test on the F/A-18 rear empennage, a method has been developed to determine actuator loads for the horizontal stabilators. A computer program called STABAG has been written which implements the method to enable automated computation of actuator loads corresponding to input spectrum points. This report describes the program and serves as an operating manual for it. GRA

N92-15074# Naval Air Development Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.
NEURAL NETWORK AND FUZZY LOGIC TECHNOLOGY FOR NAVAL FLIGHT CONTROL Interim Report, Sep. 1990 - Jul. 1991
Marc L. Steinberg and Robert D. DiGirolamo 6 Aug. 1991 44 p Sponsored by Office of Naval Technology
(AD-A242650; NADC-91080-60) Avail: NTIS HC/MF A03 CSCL 01/4

Neural networks and fuzzy logic have the potential to overcome some of the most difficult problems that occur in the design and implementation of modern flight control systems (FCS). Ultimately, this may yield significant gains in performance, robustness, cost survivability, and reliability. However, it is still uncertain what neural network and fuzzy logic functions are both technologically feasible and suitable for flight control system implementation. In this report, an ongoing comprehensive program to develop and assess this technology for Naval FCS applications is described. Currently, this program is focused on the development of a neural network FCS design tool, a neural network flight control law emulator, a fuzzy logic automatic carrier landing system, and a neural network flight control configuration management system. For each project, some initial results are given. Also, several new and planned projects are discussed. These include learning augmented adaptive control, neural network augmented nonlinear control, optical neurons, and neural augmentation of conventional control systems. GRA

N92-15075*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
FORMULATION OF A STRATEGY FOR MONITORING CONTROL INTEGRITY IN CRITICAL DIGITAL CONTROL SYSTEMS
Celeste M. Belcastro, Robert Fischl, and Moshe Kam (Drexel Univ., Philadelphia, PA.) Nov. 1991 16 p
(NASA-TM-104158; NAS 1.15:104158) Avail: NTIS HC/MF A03 CSCL 01C

Advanced aircraft will require flight critical computer systems for stability augmentation as well as guidance and control that must perform reliably in adverse, as well as nominal, operating environments. Digital system upset is a functional error mode that can occur in electromagnetically harsh environments, involves no component damage, can occur simultaneously in all channels of a redundant control computer, and is software dependent. A strategy is presented for dynamic upset detection to be used in the evaluation of critical digital controllers during the design and/or validation phases of development. Critical controllers must be able to be used in adverse environments that result from disturbances caused by an electromagnetic source such as lightning, high intensity radiated field (HIRF), and nuclear electromagnetic pulses (NEMP). The upset detection strategy presented provides dynamic monitoring of a given control computer for degraded functional integrity that can result from redundancy management errors and control command calculation error that could occur in an electromagnetically harsh operating environment. The use is discussed of Kalman filtering, data fusion, and decision theory in monitoring a given digital controller for control calculation errors, redundancy management errors, and control effectiveness.
Author

N92-15076*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TRIM DRAG REDUCTION CONCEPTS FOR HORIZONTAL TAKEOFF SINGLE-STAGE-TO-ORBIT VEHICLES
John D. Shaughnessy and Irene M. Gregory Dec. 1991 32 p
(NASA-TM-102687; NAS 1.15:102687) Avail: NTIS HC/MF A03 CSCL 01C

The results of a study to investigate concepts for minimizing trim drag of horizontal takeoff single-stage-to-orbit (SSTO) vehicles are presented. A generic hypersonic airbreathing conical configuration was used as the subject aircraft. The investigation indicates that extreme forward migration of the aerodynamic center as the vehicle accelerates to orbital velocities causes severe aerodynamic instability and trim moments that must be counteracted. Adequate stability can be provided by active control of elevons and rudder, but use of elevons to produce trim moments results in excessive trim drag and fuel consumption. To alleviate this problem, two solution concepts are examined. Active control of the center of gravity (COG) location to track the aerodynamic center decreases trim moment requirements, reduces elevon deflections, and leads to significant fuel savings. Active control of the direction of the thrust vector produces required trim moments, reduces elevon deflections, and also results in significant fuel savings. It is concluded that the combination of active flight control to provide stabilization, (COG) position control to minimize trim moment requirements, and thrust vectoring to generate required trim moments has the potential to significantly reduce fuel consumption during ascent to orbit of horizontal takeoff SSTO vehicles.
Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N92-15077*# Vigyan Research Associates, Inc., Hampton, VA.
THE NASA LANGLEY RESEARCH CENTER 0.3-METER TRANSONIC CRYOGENIC TUNNEL MICROCOMPUTER CONTROLLER SOURCE CODE
W. Allen Kilgore and S. Balakrishna Dec. 1991 66 p
(Contract NAS1-18585)
(NASA-CR-189556; NAS 1.26:189556) Avail: NTIS HC/MF A04 CSCL 14B

The 0.3 m Transonic Cryogenic Tunnel (TCT) microcomputer based controller has been operating for several thousand hours in a safe and efficient manner. A complete listing is provided of the source codes for the tunnel controller and tunnel simulator. Included also is a listing of all the variables used in these programs. Several changes made to the controller are described. These changes are to improve the controller ease of use and safety.
Author

N92-14999# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Aerothermodynamics Section.
SIMOUN AND SCIROCCO WIND TUNNEL NOZZLE VISCOUS FLOW STUDY
D. Giordano, L. Marraffa, and G. Russo (Centro Italiano Ricerche Aerospaziali, Naples.) *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 197-207 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15001# Deutsche Airbus G.m.b.H., Bremen (Germany, F.R.).
SHORT TIME FORCE MEASUREMENT SYSTEM
Josef Mertens and Klaus Koenig *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 223-227 (For primary document see N92-14973 06-02)
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N92-15002# Naples Univ. (Italy).
INFRARED MEASUREMENTS OF AERODYNAMIC HEATING IN HYPERSONIC WIND TUNNEL
L. deLuca, G. Cardone, G. M. Carlomagno, T. AlziarydeRoquefort, and D. AymerdelaChevalerie (Centre d'Essais Aeronautique Toulouse, Poitiers, France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 229-234 Sponsored by Centro Italiano Ricerche Aerospaziali and Avions Marcel Dassault-Breguet Aviation (For primary document see N92-14973 06-02)
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N92-15003# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Div. de Thermophysique.
HEAT TRANSFER MEASUREMENTS IN ONERA SUPERSONIC AND HYPERSONIC WIND TUNNELS USING PASSIVE AND ACTIVE INFRARED THERMOGRAPHY
D. L. Balageas, D. Boscher, A. A. Deom, and G. Gardette *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 235-240 Previously announced in IAA as A91-45632 Sponsored in part by Direction des Recherches, Etudes et Techniques; CEA; and Cryospace Co. (For primary document see N92-14973 06-02)
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N92-15009# Stuttgart Univ. (Germany, F.R.). Inst. fuer Raumfahrtsysteme.
THE IRS PLASMA WIND TUNNELS FOR THE INVESTIGATION OF THERMAL PROTECTION MATERIALS FOR REENTRY VEHICLES
M. Auweter-Kurtz, H. Habiger, S. Laure, E. W. Messerschmid, W. Roeck, and N. Tubanos *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 283-293 (For primary document see N92-14973 06-02)
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N92-15010# Eurespace, Blagnac (France).
SIMULATIONS OF REENTRY CONDITIONS BY PLASMA GENERATOR: THEORETICAL AND PRACTICAL LIMITS [SIMULATIONS DES CONDITIONS DE RENTREES PAR GENERATEUR DE PLASMA LIMITES THEORIQUES ET PRATIQUES]
Serge Muller *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 295-299 In FRENCH (For primary document see N92-14973 06-02)
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N92-15011# Laboratoire d'Aerothermique du CNRS, Meudon (France).
PLASMA JET WIND TUNNEL SIMULATION OF ATMOSPHERIC REENTRY [SIMULATION EN SOUFFLERIE DE PLASMAS D'ENTREE D'UN VEHICULE EN REGION ATMOSPHERIQUE]
P. Lasgorceix, M. A. Dudeck, and J. P. Caressa *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 301-305 In FRENCH (For primary document see N92-14973 06-02)
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N92-15012# Naples Univ. (Italy).
ASPECTS OF NON-EQUILIBRIUM IN ARC-HEATED WIND-TUNNEL SIMULATION
R. Monti, G. Russo, and G. Pagliocca (Techno System Developments, Naples, Italy) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 307-314 (For primary document see N92-14973 06-02)
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N92-15021# Technische Hochschule, Aachen (Germany, F.R.). Shock Wave Lab.
HIGH ENTHALPY TESTING IN THE AACHEN (FED. REPUBLIC OF GERMANY) SHOCK TUNNEL TH 2
H. Olivier, M. Vetter, and H. Groenig *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 377-384 (For primary document see N92-14973 06-02)
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N92-15043# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
REVIEW OF THE EUROPEAN HYPERSONIC WIND TUNNEL PERFORMANCE AND SIMULATION REQUIREMENTS
J. Muylaert, T. Voiron, P. Sagnier, D. Lourme, O. Papirnyk, K. Hannemann, K. Buetefisch, and Georg Koppenwallner (Hyperschall-Technologie-Goettingen, Germany, F.R.) *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 559-574 (For primary document see N92-14973 06-02)
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12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N92-15078# Committee on Commerce, Science, and Transportation (U.S. Senate).
NASA'S SPACE SCIENCE PROGRAMS AND THE MISSION TO PLANET EARTH
Washington GPO 1991 99 p Hearing before the Committee on Commerce, Science, and Transportation, 102d Congress, 1st Session, 24 Apr. 1991
(S-Hrg-102-270; GPO-48-181; ISBN-0-16-036907-X) Avail: Subcommittee on Science, Technology, and Space, Senate, Washington, DC 20510 HC free; also available SOD HC $3.00 as 552-070-11532-3

Hearings before the Subcommittee on Science, Technology, and Space of the Senate Committee on Commerce, Science, and Transportation are presented for the National Aeronautics and Space Administration's (NASA's) space science programs and the Mission to Planet Earth. All written testimony and submittals for the record are included. The fiscal year 1992 space science and applications budget focuses on three themes: (1) the timely execution of core space science missions; (2) the vigorous pursuit of Mission to Planet Earth; and (3) increased support for basic research. These themes have been recommended by a variety of outside advisory bodies and Congress. No major new start is requested for space science. A 'small' new start is requested for a recoverable life sciences satellite to be called Lifesat, which would serve both Mission to Planet Earth and future space habitation and exploration. Funding is also requested to augment the research and analysis programs at universities and NASA Centers. Various ways to obtain atmospheric and tropospheric measurements in a timely fashion and to minimize gaps in measurements are discussed. J.P.S.

N92-15079*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
LUNAR MISSION AEROBRAKE PERFORMANCE STUDY
J. Mulqueen and D. Coughlin Dec. 1991 42 p
(NASA-TM-103562; NAS 1.15:103562) Avail: NTIS HC/MF A03 CSCL 22A

Nine lunar mission scenarios were developed to show the transfer vehicle performance benefits of aerobraking into low Earth orbit (LEO) upon Earth return as opposed to an all-propulsive maneuver. The initial mass in LEO (IMLEO) of the lunar transfer vehicle is considered the measure of vehicle performance. Four types of mission profiles in conjunction with two vehicle concepts were used to construct the scenarios. These nine scenarios were designed to represent a broad range of possible lunar missions so that a general knowledge base of aerobraking and lunar transfer vehicle performance levels could be obtained. Also discussed are the mass sensitivities of each transfer vehicle to changes in the selected design parameters: Isp, crew module mass, payload to surface, and aerobrake mass fraction. A parametric study was performed on two of the mission scenarios to help quantify the performance benefits by adding a set of drop tanks to the vehicle. The parametric study also provides partial derivatives which show the sensitivities of IMLEO to the four design parameters listed. A ranking is given based on vehicle performance. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

N92-15080*# Texas A&M Univ., College Station. Aerospace Engineering Div.
CONTROL ALGORITHMS FOR AEROBRAKING IN THE MARTIAN ATMOSPHERE Final Report
Donald T. Ward and Buford W. Shipley, Jr. Sep. 1991 170 p
Sponsored by NASA. Lyndon B. Johnson Space Center

(NASA-CR-185665; NAS 1.26:185665; TEES-AERO-91-1) Avail: NTIS HC/MF A08 CSCL 22A

The Analytic Predictor Corrector (APC) and Energy Controller (EC) atmospheric guidance concepts were adapted to control an interplanetary vehicle aerobraking in the Martian atmosphere. Changes are made to the APC to improve its robustness to density variations. These changes include adaptation of a new exit phase algorithm, an adaptive transition velocity to initiate the exit phase, refinement of the reference dynamic pressure calculation and two improved density estimation techniques. The modified controller with the hybrid density estimation technique is called the Mars Hybrid Predictor Corrector (MHPC), while the modified controller with a polynomial density estimator is called the Mars Predictor Corrector (MPC). A Lyapunov Steepest Descent Controller (LSDC) is adapted to control the vehicle. The LSDC lacked robustness, so a Lyapunov tracking exit phase algorithm is developed to guide the vehicle along a reference trajectory. This algorithm, when using the hybrid density estimation technique to define the reference path, is called the Lyapunov Hybrid Tracking Controller (LHTC). With the polynomial density estimator used to define the reference trajectory, the algorithm is called the Lyapunov Tracking Controller (LTC). These four new controllers are tested using a six degree of freedom computer simulation to evaluate their robustness. The MHPC, MPC, LHTC, and LTC show dramatic improvements in robustness over the APC and EC. Author

N92-15037# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE INFLUENCE OF A RETARDING ROCKET ON PARAMETER LIMITS FOR REENTRY TRAJECTORIES
N. Oren *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 505-507 (For primary document see N92-14973 06-02)
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N92-15466*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SATELLITE ORBIT CONSIDERATIONS FOR A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
Edwin F. Harrison, Gary G. Gibson, John T. Suttles, James J. Buglia, and Israel Taback (Bionetics Corp., Hampton, VA.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 91-108 Previously announced as N91-25557 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22A

N92-15858*# Alabama Univ., Huntsville. Dept. of Mathematical Sciences.
A MINIMUM PROPELLANT SOLUTION TO AN ORBIT-TO-ORBIT TRANSFER USING A LOW THRUST PROPULSION SYSTEM
Shannon S. Cobb *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 22A

N92-15894*# Louisiana Coll., Pineville. Dept. of Mathematics and Computer Science.
A HIGH-FIDELITY N-BODY EPHEMERIS GENERATOR FOR SATELLITES IN EARTH ORBIT
David R. Simmons *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 6 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N92-15081* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ELECTROMAGNETIC MEISSNER EFFECT LAUNCHER Patent
Glen A. Robertson, inventor (to NASA) 21 May 1991 9 p Filed 31 Oct. 1989
(NASA-Case-MFS-28323-1; US-Patent-5,017,549; US-Patent-Appl-SN-429515; US-Patent-Class-505-1; US-Patent-Class-89-8; US-Patent-Class-124-3; US-Patent-Class-244-63; Int-Patent-Class-F41B-6/00) Avail: US Patent and Trademark Office CSCL 14B

An electromagnetic projectile launcher provides acceleration of a superconducting projectile through the diamagnetic repulsion of the superconducting projectile. A superconducting layer is provided aft of the projectile, either directly on the projectile or on a platform upon which the projectile is carried, and a traveling magnetic field is caused to propagate along a magnetic field drive coil in which the projectile is disposed. The resulting diamagnetic repulsion between the superconducting projectile and the traveling magnetic field causes the projectile to be propelled along the coil. In one embodiment, a segmented drive coil is used to generate the traveling magnetic field.

Official Gazette of the U.S. Patent and Trademark Office

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

No abstracts in this category.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N92-15082*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SEALS FLOW CODE DEVELOPMENT
Mar. 1991 172 p Workshop held in Cleveland, OH, 26 Mar. 1991
(NASA-CP-10070; E-6219; NAS 1.55:10070) Avail: NTIS HC/MF A08 CSCL 11A

In recognition of a deficiency in the current modeling capability for seals, an effort was established by NASA to develop verified computational fluid dynamic concepts, codes, and analyses for seals. The objectives were to develop advanced concepts for the design and analysis of seals, to effectively disseminate the information to potential users by way of annual workshops, and to provide experimental verification for the models and codes under a wide range of operating conditions. For individual titles, see N92-15083 through N92-15105.

N92-15083*# Mechanical Technology, Inc., Latham, NY.
INDUSTRIAL CODE DEVELOPMENT **c37**
Wilbur Shapiro *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 15-26 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The industrial codes will consist of modules of 2-D and simplified 2-D or 1-D codes, intended for expeditious parametric studies, analysis, and design of a wide variety of seals. Integration into a unified system is accomplished by the industrial Knowledge Based System (KBS), which will also provide user friendly interaction, contact sensitive and hypertext help, design guidance, and an expandable database. The types of analysis to be included with the industrial codes are interfacial performance (leakage, load, stiffness, friction losses, etc.), thermoelastic distortions, and dynamic response to rotor excursions. The first three codes to be completed and which are presently being incorporated into the KBS are the incompressible cylindrical code, ICYL, and the compressible cylindrical code, GCYL. Author

N92-15084*# CFD Research Corp., Huntsville, AL.
DEVELOPMENT OF A CFD CODE FOR ANALYSIS OF FLUID DYNAMIC FORCES IN SEALS **c34**
Mahesh M. Athavale, Andrzej J. Przekwas, and Ashok K. Singhal *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 27-39 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 20D

The aim is to develop a 3-D computational fluid dynamics (CFD) code for the analysis of fluid flow in cylindrical seals and evaluation of the dynamic forces on the seals. This code is expected to serve as a scientific tool for detailed flow analysis as well as a check for the accuracy of the 2D industrial codes. The features necessary in the CFD code are outlined. The initial focus was to develop or modify and implement new techniques and physical models. These include collocated grid formulation, rotating coordinate frames and moving grid formulation. Other advanced numerical techniques include higher order spatial and temporal differencing and an efficient linear equation solver. These techniques were implemented in a 2D flow solver for initial testing. Several benchmark test cases were computed using the 2D code, and the results of these were compared to analytical solutions or experimental data to check the accuracy. Tests presented here include planar wedge flow, flow due to an enclosed rotor, and flow in a 2D seal with a whirling rotor. Comparisons between numerical and experimental results for an annular seal and a 7-cavity labyrinth seal are also included. Author

N92-15085*# Mechanical Technology, Inc., Latham, NY.
KBS DEVELOPMENT **c61**
Bharat Aggarwal *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 41-46 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 09B

The Knowledge Based System (KBS) has two main objectives, the provision of easy access to all the industrial and scientific codes through an executive program, and the provision of an easy to use user interface for the analysis codes. The user interface is designed to minimize the effort expended in dealing with the mechanics of using a computer, allowing the user to concentrate on seal design and analysis. Author

N92-15086*# Mechanical Technology, Inc., Latham, NY.
KBS DEMONSTRATION **c61**
Bharat Aggarwal, Antonio Artiles, and William Shapiro *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 47-50 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 09B

The Knowledge Based System (KBS) demonstration included five different items: the executive program, three of the industrial codes, and graphical display capability using current MYI MS-DOS programs. The graphics capability included two and three dimensional plots viewed from different angles. This capability will be ported to OS/2 and made an integral part of the KBS executive program. The three codes demonstrated included Spiral Groove Gas Seals (SPIRAL), Gas Cylindrical Seals (GCYL), and Incompressible Seals (ICYL). The SPIRAL and GCYL interface has the standard PM interface, while the ICYL interface was designed using ToolBook. Author

N92-15087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SEALS RELATED RESEARCH AT NASA. LEWIS RESEARCH CENTER **c37**
Robert C. Hendricks *In its* Seals Flow Code Development Mar. 1991 p 53-65 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

Some current efforts in seal research at the Lewis Research Center include self-sealing linear segmented ceramic configurations, the T700 brush seal engine test, flow and duration characteristics of brush seals and other configurations, cryogenic hydrogen brush seal tests, and a brush seal tester. Information is given in diagram and graphs for a labyrinth seal and a straight cylindrical seal. Author

N92-15088*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
NASA. MARSHALL SPACE FLIGHT CENTER HYDROSTATIC BEARING ACTIVITIES **c37**
Theodore G. Benjamin *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 67-73 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The basic approach for analyzing hydrostatic bearing flows at the Marshall Space Flight Center (MSFC) is briefly discussed. The Hydrostatic Bearing Team has responsibility for assessing and evaluating flow codes; evaluating friction, ignition, and galling effects; evaluating wear; and performing tests. The Office of Aerospace and Exploration Technology Turbomachinery Seals Tasks consist of tests and analysis. The MSFC in-house analyses utilize one-dimensional bulk-flow codes. Computational fluid dynamics (CFD) analysis is used to enhance understanding of bearing flow physics or to perform parametric analysis that are outside the bulk flow database. As long as the bulk flow codes are accurate enough for most needs, they will be utilized accordingly and will be supported by CFD analysis on an as-needed basis. Author

N92-15089*# Army Propulsion Lab., Cleveland, OH.
ARMY RESEARCH CONCERNS IN ENGINE SEALING **c37**
Robert C. Bill *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 75-82 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The Army Propulsion Directorate is primarily concerned with small engine technology, where sealing performance is most critical. Tip leakage and secondary flow losses have a much greater performance impact on small engine aero-components than on large engines. A brief survey and critique of presently employed sealing concepts is presented. Some recent new research thrusts that show promise for substantial improvement are discussed. An especially promising approach for small engine applications is brush seals. Brush seal concepts are being considered for outer air seal and secondary airflow system seal locations. Author

N92-15090*# Texas A&M Univ., College Station. Turbomachinery Lab.
SEALS RESEARCH AT TEXAS A/M UNIVERSITY **c37**
Gerald L. Morrison *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 83-100 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The Turbomachinery Laboratory at Texas A&M has been providing experimental data and computational codes for the design seals for many years. The program began with the development

of a Halon based seal test rig. This facility provided information about the effective stiffness and damping in whirling seals. The Halon effectively simulated cryogenic fluids. Another test facility was developed (using air as the working fluid) where the stiffness and damping matrices can be determined. This data was used to develop bulk flow models of the seal's effect upon rotating machinery; in conjunction with this research, a bulk flow model for calculation of performance and rotordynamic coefficients of annular pressure seals of arbitrary non-uniform clearance for barotropic fluids such as LH2, LOX, LN2, and CH4 was developed. This program is very efficient (fast) and converges for very large eccentricities. Currently, work is being performed on a bulk flow analysis of the effects of the impeller-shroud interaction upon the stability of pumps. The data was used along with data from other researchers to develop an empirical leakage prediction code for MSFC. Presently, the flow field inside labyrinth and annular seals are being studied in detail. An advanced 3-D Doppler anemometer system is being used to measure the mean velocity and entire Reynolds stress tensor distribution throughout the seals. Concentric and statically eccentric seals were studied; presently, whirling seals are being studied. The data obtained are providing valuable information about the flow phenomena occurring inside the seals, as well as a data base for comparison with numerical predictions and for turbulence model development. A finite difference computer code was developed for solving the Reynolds averaged Navier Stokes equation inside labyrinth seals. A multi-scale k-epsilon turbulence model is currently being evaluated. A new seal geometry was designed and patented using a computer code. A large scale, 2-D seal flow visualization facility is also being developed.

Author

N92-15091*# Akron Univ., OH.
SEALS RESEARCH AT THE UNIVERSITY OF AKRON Abstract Only **c37**
M. Jack Braun *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 101 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The flow visualization aims at determining the flow regimes and the sealing mechanisms that are at work in the brush seal, regardless of whether the seal is linear or circular. A vision system coupled with an image processing system is used to analyze the nature of the flow. Pressure measurements were made to study the effect of the number of brushes as well as the brush structure on the seal effectiveness. Details of a numerical approach to flow simulation in one hydrostatic pocket is presented. The effects of the jet, shaft velocity, and clearance on the flow patterns and pressure generation are described. Author

N92-15092*# Air Force Systems Command, Wright-Patterson AFB, OH. Lubrication Branch.
PROGRAMS AT WRIGHT-PATTERSON AIR FORCE BASE **c37**
Ron Dayton *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 103-106 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The Lubrication Branch has two active programs that are developing gas turbine engine mainshaft air/oil seals. Both of these programs, one of which is with General Electric Aircraft Engines and the other with Pratt & Whitney Aircraft, are addressing counter-rotating intershaft applications which involve very high rubbing velocities. The objectives and requirements of these efforts are briefly addressed. Author

N92-15093*# Detroit Diesel Allison, MI.
SEAL DEVELOPMENT ACTIVITIES AT ALLISON TURBINE DIVISION Abstract Only **c37**
John Munson *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 107 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

Brush seals are being evaluated for potential near and far term gas turbine engine applications. Development is in the form of rig component testing and engine testing. Allison has tested an engine with 20 individual brush seal positions. These seals were located throughout the engine. The emphasis of the current work is on obtaining long term performance data for brush seals. Very little of this data is available. Allison is presently developing film riding face seal technology to support future gas turbine engine applications. A face seal with an approximate 7 inch diameter was successfully tested to 1000 F, 100 psid, and 650 ft/sec. Seal leakage remained below 1 scfm throughout the duration of the test. A model for the compressible gas film was developed which separates the model for the compressible gas film was developed which separates the primary seal rings during operation. This model is based on the traditional Reynold's approach which is customarily applied to lubrication type problems. Because of the difficulty of experimentally verifying the program predictions, a commercial Navier-Stokes code was used in parallel. By comparing predictions for similar cases, it is expected that the limitations of the Reynold's model can be assessed as it applies to this particular seal.

Author

N92-15094*# General Electric Co., Cincinnati, OH.
AREAS OF SEAL R/D AT GE **c37**
A. Nelson Pope *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 109-112 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

About four years ago, work was completed on a 36 inch diameter gas to gas carbon ring seal used to buffer low pressure turbine air at the rim of the forward outer flowpath on the GE36 unducted fan (UDF) engine. At about the same time, we were developing a long life counter-rotating intershaft air-oil seal of approximately 7.6 inch diameter for operation at 800 fps, 800 F, and 50 psid. Although we were successful in meeting most program goals with a split ring seal of the axial bushing type, the seal with the greatest payoff in life and air leakage rates, bearing many features in common with the GE36 seal, could not be successfully tested because of the structural weakness of the primary seal ring carbon material. This was a split ring seal using a hybrid combination of orifice compensated hydrostatic and shrouded hydrodynamic gas bearings. We are presently working to develop this design in conjunction with high strength materials being developed by Pure Carbon Co. In the area of engine secondary gas flow path-sealing for performance improvement, we are currently working with carbon and all metal face seals. A 15 inch diameter all metal 'aspirating' face seal, using self-acting hydrostatic bearings, was successfully tested to 700 fps, 100 psid, and 1000 F, demonstrating long life at flow reduction of 86 percent compared to a 'best' labyrinth. This seal will be developed through 1400 F, 900 fps, and 350 psid. The seal 'aspirates' closed at about idle speed pressure during engine start and reopens at engine shutdown. A hydraulic thrust balance seal, currently using orifice compensated hydrostatics, is under development. Other aspects of these projects are briefly covered. Author

N92-15095*# Edgerton, Germeshausen and Grier, Inc., Wellesley, MA. Fluid Components Technology Group.
SEAL RELATED DEVELOPMENT ACTIVITIES AT EG/G **c37**
Harold F. Greiner *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 113-122 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

Seal related development activities including modeling, analysis, and performance testing are described for several current seal related projects. Among the current seal related projects are the following: high pressure gas sealing systems for turbomachinery; brush seals for gas path sealing in gas turbines; and tribological material evaluation for wear surfaces in sealing systems. Author

N92-15096*# Mechanical Seal Technology, Albuquerque, NM.
THE APPLICATION OF DIFFERENTIAL ROUGHNESS TO MITIGATE FRICTION AND WEAR Abstract Only **c37**
Alan O. Lebeck *In* NASA. Lewis Research Center, Seals Flow

Code Development Mar. 1991 p 125 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

By definition, differential roughness occurs where the surface roughness of one region is distinctly different from that of an adjacent region. Differential roughness may occur on a sliding surface when the structure of an area of the surface is modified relative to the original material. Differential roughness may be used to effect a film thickness change so as to cause hydrodynamic or hydrostatic lubrication effects just as if the surfaces were machined. The advantage of differential roughness is that the effective offset of film thickness continues to exist even if there is gross wear. One can effect film thickness changes which are smaller than can be made directly. Furthermore, asperity tip load support is the same over both the high roughness and small roughness regions. The potential uses for differential roughness are seals, bearings, and pumps. Some examples are presented. Author

N92-15097*# Rockwell International Corp., Canoga Park, CA. Advanced Rotating Machinery Div.
SEAL TECHNOLOGY AT ROCKETDYNE c37
Joe Scharrer *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 127-122 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

Seal codes currently in use and their capabilities are discussed. Among the codes currently in use are codes for simulating floating ring seals, face seals, and load sharing seals. New codes that will extend simulation capability to barotropic fluid properties, phase change, brush seal performance, large scale roughness, and asymmetric boundary conditions are under development. Planned seal testing and fluid film bearing activity are also presented.
Author

N92-15098*# Aerojet-General Corp., Sacramento, CA.
CFD ACTIVITY AT AEROJET RELATED TO SEALS AND FLUID FILM BEARING c37
George E. Bache *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 133-138 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

Computational Fluid Dynamics (CFD) activities related to seals and fluid film bearings are presented. Among the topics addressed are the following: Aerovisc Numeric and its capabilities; Recent Seal Applications; and Future Code Developments. Author

N92-15099*# Pratt and Whitney Aircraft, West Palm Beach, FL.
PRATT AND WHITNEY ACTIVITIES c37
Saadat A. Syed *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 139-143 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

An example of Computational Fluid Dynamics (CFD) application in the seal area is described. This effort consisted of optimizing specific seals in the Space Shuttle Main Engine Alternate Turbopump Development (SSME ATD) and resulted in design of a seal tested which demonstrated 30 percent lower leakage than the standard design at the same clearance. This example shows the potential of identifying seal geometry parameters which reduce internal flow leakages detrimental to component and turbopump efficiencies. This information can than be used to develop an analytical design procedure for controlling leakage in any given application or environment. Author

N92-15100*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
CFD APPLICATIONS IN PROPULSION c37
Charles L. Merkle *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 145-154 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

An overview of various applications of Computational Fluid Dynamics (CFD) algorithms to propulsion problems is given. Topics of interest include incompressible, low speed compressible, transonic, and supersonic problems. A common family of algorithms is used for all applications and emphasis is placed on maintaining accuracy and convergence efficiency for all problems. Specific problems include pump hydrodynamics, simultaneous combustion and mixing in rocket engines, viscous nozzle flow, and CFD applications to combustion stability. Author

N92-15101*# Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
STATUS UPDATE ON THE SEAL/BEARING ROTORDYNAMICS TEST FACILITY AT CASE WESTERN RESERVE UNIVERSITY c37
Michael L. Adams *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 155-162 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The CWRU Seal/Bearing test facility is shown along with the revised force measuring system. This facility has recently been retrofitted with a high pressure, high flow oil system. The high pressure high flow water system remains in place to test seals. Also, a new high flow air system is now installed. Thus, testing to determine static and dynamic properties can now be performed using oil, water, or air on this single facility. The oil system is currently being used to determine rotordynamic properties of a NASA four pocket hydrostatic journal bearing. The revised dual system force measuring configuration is performing with excellent accuracy. That is, the dynamic force measurements are made simultaneously with two independent systems, one with piezoelectric load cells and the other with strain gage load cells. The difference is less than 2 pct. between these two sets of load cell measurements on recent tests with a static eccentricity set close to zero and an orbit radius of 0.0004 inch. The extracted stiffness, damping and inertia coefficients is given for the test conditions shown, as extracted from the two independent dynamic force measurements. Author

N92-15102*# Massachusetts Inst. of Tech., Cambridge.
SEAL TEST PROGRAM AT MIT Abstract Only c37
Manual Martinez-Sanchez and K. T. Millsaps, Jr. *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 163 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

A seal test program is reported on which was conducted in a dynamic rig. Four different 1-gland labyrinths were tested. The eccentricity, spin rate, whirl rate, and flow are varied independently. Author

N92-15103*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NATIONAL AEROSPACE PLANE ENGINE SEALS: HIGH TEMPERATURE SEAL PERFORMANCE EVALUATION c37
Bruce M. Steinetz *In its* Seals Flow Code Development Mar. 1991 p 165-170 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

The key to the successful development of the single stage to orbit National Aerospace Plane (NASP) is the successful development of combined cycle ramjet/scramjet engines that can propel the vehicle to 17,000 mph to reach low Earth orbit. To achieve engine performance over this speed range, movable engine panels are used to tailor engine flow that require low leakage, high temperature seals around their perimeter. NASA-Lewis is developing a family of new high temperature seals to form effective barriers against leakage of extremely hot (greater than 2000 F), high pressure (up to 100 psi) flow path gases containing hydrogen and oxygen. Preventing backside leakage of these explosive gas mixtures is paramount in preventing the potential loss of the engine or the entire vehicle. Seal technology development accomplishments are described in the three main areas of concept development, test, and evaluation and analytical development.
Author

N92-15104*# Yosemite Systems, Inc., Alexandria, VA.
VOLUME VISUALIZATION AND KNOWLEDGE INTEGRATION Abstract Only **c61**
Thomas Cochrane *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 171 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 09B

A discussion is presented of how advanced computer graphics visualization techniques and integration of knowledge throughout the concept to production cycle are providing tools to revolutionize the design process. Relevant projects that are used as examples are at USAF, Ford, Digital, EPA, and DOE. Author

N92-15105*# British Hydromechanics Research Association, Cranfield (England).
FLUID SEALS TECHNOLOGY AT BHR GROUP LTD. Abstract Only **c37**
Simon Leefe *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 173 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

A mathematical model was developed for ESA, which couples the rigid body dynamics in four degrees of freedom of a flexibly mounted stator (with Coulomb damping) of a turbopump face seal with the fluid film behavior. The interfacial film is assumed gaseous, and the model incorporates laminar/turbulent flow, inertia and sonic choking. Seal faces may be wavy and coned, while the rotating ring can be eccentrically mounted, misaligned with the shaft and oscillate axially at arbitrary frequency. The model is currently being coded into software. An experimental program using a high speed cryogenic/hot gas test rig is being conducted to verify the output of the computer program. Author

N92-15106# General Accounting Office, Washington, DC.
SPACE SHUTTLE: NASA FACES CHALLENGES IN ITS ATTEMPT TO ACHIEVE PLANNED FLIGHT RATES
Dec. 1991 50 p
(GAO/NSIAD-92-32; B-246151) Avail: NTIS HC/MF A03

At the request of the Subcommittee on VA, HUD, and Independent Agencies of the Senate Committee on Appropriations, the General Accounting Office (GAO) reviewed the National Aeronautics and Space Administration's (NASA) plans for future shuttle flights. Specifically, they evaluated the (1) factors associated with achieving planned flight rates, (2) processes to ensure that safety is not compromised by increasing flight rates, (3) impact of variations in flight rate estimates on procurement of subsystems and spare parts, and (4) planned use of expendable launch vehicles for payloads not requiring the shuttle. NASA has reduced its projection of the maximum annual shuttle flight rate to 10 flights a year and does not anticipate flying at this rate before late in the decade. Unless NASA can reduce shuttle ground processing time, GAO calculates that NASA will not be able to consistently launch the shuttle more that 7 or 8 times a year. No evidence was found to suggest that NASA might compromise safety to create the flight rate or that overly optimistic flight rate projections have resulted in excess procurement of spare parts. GAO notes some inefficiencies in the production of subsystems such as external tanks and solid rocket boosters, due primarily to funding constraints. NASA is evolving from a policy of almost exclusive reliance on the shuttle to launch its payloads to one of using the shuttle only when necessary. The report recommends that the Administrator implement plans to reduce advanced solid rocket manufacturing equipment to be consistent with current shuttle flight rate estimates and determine how much could be saved by reducing the size of motor manufacturing facilities. J.P.S.

N92-15107*# Carnegie-Mellon Univ., Pittsburgh, PA. School of Computer Science.
AN ANALYSIS OF SPACE SHUTTLE COUNTDOWN ACTIVITIES: PRELIMINARIES TO A COMPUTATIONAL MODEL OF THE NASA TEST DIRECTOR
Bonnie E. John, Roger W. Remington, and David M. Steier 31 May 1991 47 p
(Grant NAG2-634)
(NASA-CR-189754; NAS 1.26:189754; CMU-CS-91-138) Avail: NTIS HC/MF A03 CSCL 22B

Before all systems are go just prior to the launch of a space shuttle, thousands of operations and tests have been performed to ensure that all shuttle and support subsystems are operational and ready for launch. These steps, which range from activating the orbiter's flight computers to removing the launch pad from the itinerary of the NASA tour buses, are carried out by launch team members at various locations and with highly specialized fields of expertise. The liability for coordinating these diverse activities rests with the NASA Test Director (NTD) at NASA-Kennedy. The behavior is being studied of the NTD with the goal of building a detailed computational model of that behavior; the results of that analysis to date are given. The NTD's performance is described in detail, as a team member who must coordinate a complex task through efficient audio communication, as well as an individual taking notes and consulting manuals. A model of the routine cognitive skill used by the NTD to follow the launch countdown procedure manual was implemented using the Soar cognitive architecture. Several examples are given of how such a model could aid in evaluating proposed computer support systems. Author

N92-14975# Tsentralni Aerogidrodinamicheskii Inst., Moscow (USSR).
AEROTHERMODYNAMIC CONFIGURATION OF FIRST GENERATION AEROSPACE PLANES (OF BURAN-TYPE) AND FIRST FLIGHT RESULTS
V. Ya. Neiland *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 13-22 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N92-15108# Ballistic Research Labs., Aberdeen Proving Ground, MD.
AN ALTERNATIVE HARDWARE TELEMETRY TECHNIQUE Final Technical Report, Mar. - Nov. 1990
Todd E. Rosenberger, Nathan E. Boyer, Joseph W. Colburn, and Phillip G. Reeves Oct. 1991 28 p
(DA Proj. 1L1-61102-AH-43)
(AD-A242626; BRL-TR-3285) Avail: NTIS HC/MF A03 CSCL 09/6

The effect of high frequency pressure oscillations on projectile integrity and projectile payloads is a key technical issue in the liquid propellant gun program. A great deal of effort has been directed toward the study of varying the gun system and propellant to alleviate, or at least dampen, pressure oscillations. A project was initiated to study the effects of oscillations on the projectile in a 30-mm Concept VI Regenerative Liquid Propellant gun. A unique hardwire telemetry technique was used to record projectile base pressure and acceleration through the regime in which pressure oscillations occur. A hollow, fiber composite extension rod mounted to the front of the instrumented projectile supports the transducer leads and shields them from the inbore environment. Conventional hardwire telemetry problems such as the projectile impacting with the wire before measureable travel has occurred and the projectile cutting the wire between itself and the bore are eliminated. This report describes the instrumentation and test setup of this unique hardwire telemetry technique. Data recorded using this method are presented for both liquid and solid propelling charges. Effects of high frequency pressure oscillations on the

projectile are examined and future telemetry design ideas are discussed. GRA

N92-15109*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
CIRCUIT-SWITCH ARCHITECTURE FOR A 30/20-GHz FDMA/TDM GEOSTATIONARY SATELLITE COMMUNICATIONS NETWORK
William D. Ivancic 1992 13 p Proposed for presentation at the 14th International Communications Satellite Systems Conference, Washington, DC, 22-26 Mar. 1992; sponsored by AIAA
(NASA-TM-105302; E-6649; NAS 1.15:105302; AIAA-92-122)
Avail: NTIS HC/MF A03 CSCL 09F

A circuit switching architecture is described for a 30/20 GHz frequency division, multiple access uplink/time division multiplexed downlink (FDMA/TDM) geostationary satellite communications network. Critical subsystems and problem areas are identified and addressed. Work was concentrated primarily on the space segment; however, the ground segment was considered concurrently to ensure cost efficiency and realistic operational constraints. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N92-15110# Naval Postgraduate School, Monterey, CA. Dept. of Mechanical Engineering.
STABILIZATION OF FREE-FLYING UNDERACTUATED MECHANISMS IN SPACE
Ranjan Mukherjee Sep. 1991 20 p
(AD-A242557; NPS-ME-91-03) Avail: NTIS HC/MF A03 CSCL 12/9

Underactuated mechanisms provide low cost automation and can overcome actuator failures. These mechanisms are more suitable for space applications mainly because of their lower weight and lower power consumption. Typical examples of useful underactuated mechanisms in space would be large space structures and robot manipulators. Such mechanisms are however difficult to control because of the fewer number of actuators in the system. In this paper we formulate the dynamics of an underactuated mechanism using Hamilton's canonical equations. Next, we develop a theorem that provides us with some necessary and some sufficient conditions for the asymptotic stability of autonomous systems. This theorem is more powerful than LaSalle's theorem when higher order derivatives of the Liapunov function can be easily computed. Finally, we use a Liapunov function approach to develop a control strategy that will stabilize an underactuated mechanism in space to an equilibrium manifold. The effectiveness of such control is verified using our asymptotic stability theorem. GRA

N92-15111# Naval Research Lab., Washington, DC.
A LASER TEST SET FOR THE LOW-POWER ATMOSPHERIC COMPENSATION EXPERIMENT SATELLITE Final Report, Jun. 1987 - Sep. 1990
J. A. Welch, B. Light, G. L. Trusty, and T. H. Cosden 24 Oct. 1991 51 p
(AD-A242703; NRL-9360) Avail: NTIS HC/MF A04 CSCL 14/2

A laser test set (LATS) was designed for the Low-Power Atmospheric Compensation Experiment (LACE) satellite. LATS provided functional tests for the satellite prior to launch. Laser radiation replicating to be employed in the satellite experiments irradiated the satellite sensors to qualitatively verify performance. LATS required a rapid, automated goniometer 2-axis pointing system. The algorithm to correct for the tangential distortion that is introduced when a spherical surface is mapped onto a planar target is described in detail. GRA

N92-15112# Naval Research Lab., Washington, DC.
DEVICE UPSET PREDICTIONS FOR THE CHEMICAL RELEASE AND RADIATION EFFECTS SATELLITE (CRRES): A SUMMARY Interim Report, 1986 - 1990
James B. Langworthy 14 Nov. 1991 14 p
(AD-A242704; NRL-MR-6913) Avail: NTIS HC/MF A03 CSCL 07/4

This report summarizes predictions of upset rate for all electronic devices in the Chemical Release and Radiation Effects Satellite (CRRES) microelectronic package for which test data was obtainable as a function of orbit time/position. Environment and orbit are described and device parameters are listed. A brief description of necessary changes to the code used is given. A full report to follow will, besides filling in detail, consider the requirements for a code package capable of making predictions and comparisons for CRRES and will consider strategies for extracting information from the CRRES experiment. For example, the full report will recommend that fluences and upsets be accumulated in B and L space bins for the best statistical sampling. GRA

N92-15113*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION FREEDOM. A FOOTHOLD ON THE FUTURE
Leonard David [1988] 47 p LIMITED REPRODUCIBILITY: More than 20% of this document may be affected by color photographs
(NP-107/10-88) Avail: NTIS HC/MF A03; 47 functional color pages CSCL 22B

A general account of the Space Station Freedom, accompanied by many color photographs and drawings, is given. Topics covered include conducting science in space, living in space, the use of the Space Station in space exploration missions, orbital mechanics, Space Station configuration evolution, and future space scenarios. Author

N92-15114* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
HYPERVELOCITY IMPACT SHIELD Patent
Burton G. Cour-Palais, inventor (to NASA) and Jeanne Lee Crews, inventor (to NASA) 26 Nov. 1991 12 p Filed 30 Apr. 1990 Supersedes N90-26858 (28 - 21, p 2966)
(NASA-Case-MSC-21420-1; US-Patent-5,067,388; US-Patent-Appl-SN-516573; US-Patent-Class-89-36.02; US-Patent-Class-89-36.11; US-Patent-Class-244-158R; Int-Patent-Class-F41H-5/04) Avail: US Patent and Trademark Office CSCL 22B

A hypervelocity impact shield and method for protecting a wall structure, such as a spacecraft wall, from impact with particles of debris having densities of about 2.7 g/cu cm and impact velocities up to 16 km/s are disclosed. The shield comprises a stack of ultra thin sheets of impactor disrupting material supported and arranged by support means in spaced relationship to one another and mounted to cover the wall in a position for intercepting the particles. The sheets are of a number and spacing such that the impacting particle and the resulting particulates of the impacting particle and sheet material are successively impact-shocked to a thermal state of total melt and/or vaporization to a degree as precludes perforation of the wall. The ratio of individual sheet thickness to the theoretical diameter of particles of debris which may be of spherical form is in the range of 0.03 to 0.05. The spacing between adjacent sheets is such that the debris cloud plume of liquid and vapor resulting from an impacting particle penetrating a sheet does not puncture the next adjacent sheet prior to the arrival thereat of fragment particulates of sheet material and the debris particle produced by a previous impact.
Official Gazette of the U.S. Patent and Trademark Office

N92-15115# Moscow State Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki.
EXPERIMENT AT THE KOSMOS-1870 SATELLITE, PART 1
V. V. Abramenko, S. E. Belousov, and S. Yu. Dudkin 1990 20 p In RUSSIAN
(DE91-639914; NIIYaF-MGU-90-7-153-Pt-1) Avail: NTIS HC/MF A03

An experiment on investigating the cosmic radiation is conducted on the Kosmos-1870 satellite. A part of the experiment dealing with the investigation into 8-30 MeV energy electron spectrum in the region of the geomagnetic equator is described. Description of the SEhZ-8MA-01 spectrometer installed in the Kosmos-1870 satellite is presented and its characteristics are given. DOE

N92-15116*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SPACE STATION FREEDOM CONTINGENCY REBOOST AND RESUPPLY STRATEGIES
Patrick A. Troutman, Jonathan N. Cruz, Michael L. Heck, Daniel D. Mazanek, and Renjith R. Kumar (Analytical Mechanics Associates, Inc., Hampton, VA.) Oct. 1991 79 p
(NASA-TM-104169; NAS 1.15:104169) Avail: NTIS HC/MF A05 CSCL 22B

The objective of this study was to determine the requirements necessary to ensure a viable Space Station Freedom (SSF) in the event of a delay in the date of the first element launch, and/or in the event that the nominal assembly sequence is interrupted, perhaps due to a delay in the Space Shuttle Launch Schedule. Orbit lifetimes, reboost fuel requirements, and controllability requirements were calculated for each stage of the SSF assuming anywhere from a 6 to 24 month delay/interruption in the baseline SSF assembly sequence. These results were assessed in order to formulate strategies to assure SSF viability in the presence of assembly sequence delays and interruptions. Author

N92-14977# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ANALYSIS TOOLS OF ONERA AND DLR FOR THE AEROTHERMODYNAMICS OF REENTRY VEHICLES
P. Barillot, J. M. Bousquet, G. Brenner, J. L. DaCosta, D. Devezeaux, P. Niederdrenk, R. Radespiel, P. Sagnier, and J. Schoene (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick, Germany, F.R.) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 39-46 Previously announced in IAA as A91-53246 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-14980# Alenia Spazio S.p.A., Naples (Italy).
AEROTHERMODYNAMIC DEVELOPMENT OF THE CARINA RE-ENTRY VEHICLE: CFD ANALYSES AND EXPERIMENTAL TESTS
A. Marzano, M. Solazzo, A. Sansone, A. Capuano, and G. Borriello *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 67-72 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15469*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUNSYNCHRONOUS LOW EARTH ORBIT SPACECRAFT CONCEPTS AND TECHNOLOGY REQUIREMENTS FOR GLOBAL CHANGE MONITORING
L. Bernard Garrett, Ansel J. Butterfield, Israel Taback, Paul A. Garn, and Donald R. Burrowbridge, Jr. (Spartan Space Services, Glendale, AZ.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 187-270 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

N92-15470*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HOOP COLUMN SOIL MOISTURE SPACECRAFT IN LOW EARTH ORBIT FOR GLOBAL CHANGE MONITORING
Melvin J. Ferebee, Jr. *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 271-280 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

N92-15471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GEOSTATIONARY ORBIT EARTH SCIENCE PLATFORM CONCEPTS FOR GLOBAL CHANGE MONITORING
Jeffery T. Farmer, Thomas G. Campbell, William T. Davis, Paul A. Garn, Charles B. King, and Cheryl C. Jackson (Flight Mechanics and Control, Inc., Hampton, VA.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 282-291 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

N92-15472*# Bionetics Corp., Hampton, VA.
OPTIONS IN THE GLOBAL CHANGE FLEET ARCHITECTURE PROVIDED BY THE PRESENCE OF AN EOS-A AND -B
Warren D. Hypes and Rogard T. Ross (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.) *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study Sep. 1991 p 293-308 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

N92-15886*# Alabama Univ., Tuscaloosa. Industrial Engineering.
EMERGENCY EGRESS REQUIREMENTS FOR SPACE STATION FREEDOM
Paul S. Ray *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N92-15117*# Sverdrup Technology, Inc., Huntsville, AL.
ROVER NUCLEAR ROCKET ENGINE PROGRAM: OVERVIEW OF ROVER ENGINE TESTS Final Report
J. L. Finseth Feb. 1991 266 p
(Contract NAS8-37814)
(NASA-CR-184270; NAS 1.26:184270) Avail: NTIS HC/MF A12 CSCL 21H

The results of nuclear rocket development activities from the inception of the ROVER program in 1955 through the termination of activities on January 5, 1973 are summarized. This report discusses the nuclear reactor test configurations (non cold flow) along with the nuclear furnace demonstrated during this time frame.

Included in the report are brief descriptions of the propulsion systems, test objectives, accomplishments, technical issues, and relevant test results for the various reactor tests. Additionally, this document is specifically aimed at reporting performance data and their relationship to fuel element development with little or no emphasis on other (important) items. Author

N92-15118# Sandia National Labs., Albuquerque, NM.
MODAL SURVEY AND TEST-ANALYSIS CORRELATION OF A MULTIPLY-CONFIGURED THREE-STAGE BOOSTER
E. L. Marek, L. J. Branstetter, and A. M. Freed (SDRC, Inc., San Diego, CA.) 1991 15 p Presented at the 13th Biennial American Society of Mechanical Engineers (ASME) Mechanical Vibration and Noise Conference, Miami, FL, 22-25 Sep. 1991
(Contract DE-AC04-76DP-00789)
(DE92-001716; SAND-91-1773C; CONF-910957-3) Avail: NTIS HC/MF A03

This paper describes procedures used to produce a test-validated finite element model of a three-stage solid propellant booster system. A series of system-level modal tests were performed for several inert and live propellant configurations. Test-analysis models (TAMs) were used to provide pretest support of the live propellant system tests. Confidence in the model was established by a test-analysis correlation procedure. Optimization techniques were used to determine appropriate model updates. DOE

N92-15119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HYDROGEN ARCJET TECHNOLOGY
John M. Sankovic, John A. Hamley, Thomas W. Haag, Charles J. Sarmiento, and Francis M. Curran 1991 26 p Presented at the 22nd International Electric Propulsion Conference, Viareggio, Italy, 14-17 Oct. 1991; sponsored by AIDAA, AIAA, DGLR, and JSASS
(NASA-TM-105340; E-6707; NAS 1.15:105340; IEPC-91-018)
Avail: NTIS HC/MF A03 CSCL 21H

During the 1960's, a substantial research effort was centered on the development of arcjets for space propulsion applications. The majority of the work was at the 30 kW power level with some work at 1-2 kW. At the end of the research effort, the hydrogen arcjet had demonstrated over 700 hours of life in a continuous endurance test at 30 kW, at a specific impulse over 1000 s, and at an efficiency of 0.41. Another high power design demonstrated 500 h life with an efficiency of over 0.50 at the same specific impulse and power levels. At lower power levels, a life of 150 hours was demonstrated at 2 kW with an efficiency of 0.31 and a specific impulse of 935 s. Lack of a space power source hindered arcjet acceptance and research ceased. Over three decades after the first research began, renewed interest exists for hydrogen arcjets. The new approach includes concurrent development of the power processing technology with the arcjet thruster. Performance data were recently obtained over a power range of 0.3-30 kW. The 2 kW performance has been repeated; however, the present high power performance is lower than that obtained in the 1960's at 30 kW, and lifetimes of present thrusters have not yet been demonstrated. Laboratory power processing units have been developed and operated with hydrogen arcjets for the 0.1 kW to 5 kW power range. A 10 kW power processing unit is under development and has been operated at design power into a resistive load. Author

N92-15120*# Valparaiso Univ., IN. Dept. of Electrical and Computer Engineering.
DEVELOPMENT OF SOFTWARE TO IMPROVE AC POWER QUALITY ON LARGE SPACECRAFT
L. Alan Kraft 31 Dec. 1991 30 p
(Grant NAG3-1254)
(NASA-CR-189511; NAS 1.26:189511) Avail: NTIS HC/MF A03 CSCL 21H

To insure the reliability of a 20 kHz, AC power system on spacecraft, it is essential to analyze its behavior under many adverse operating conditions. Some of these conditions include overloads, short circuits, switching surges, and harmonic distortions. Harmonic distortions can cause malfunctions in equipment that the power system is supplying, and during extreme distortions such as voltage resonance, it can cause equipment and insulation failures due to the extreme peak voltages. HARMFLO, a power flow computer program, which was capable of analyzing harmonic conditions on three phase, balanced, 60 Hz, AC power systems, was modified to analyze single phase, 20 kHz, AC power systems. Since almost all of the equipment used on spacecraft power systems is electrically different from equipment used on terrestrial power systems, it was also necessary to develop mathematical models for the equipment to be used on the spacecraft. The results are that (1) the harmonic power now has a model of a single phase, voltage controlled, full wave rectifier; and (2) HARMFLO was ported to the SUN workstation platform. Author

N92-15121*# Alabama Agricultural and Mechanical Coll., Normal. School of Engineering and Technology.
LOW THRUST VISCOUS NOZZLE FLOW FIELDS PREDICTION Final Report, 1986-1991
G. S. Liaw and J. D. Mo Dec. 1991 25 p
(Grant NAG8-064)
(NASA-CR-189533; NAS 1.26:189533) Avail: NTIS HC/MF A03 CSCL 21H

A Navier-Stokes code was developed for low thrust viscous nozzle flow field prediction. An implicit finite volume in an arbitrary curvilinear coordinate system lower-upper (LU) scheme is used to solve the governing Navier-Stokes equations and species transportation equations. Sample calculations of carbon dioxide nozzle flow are presented to verify the validity and efficiency of this code. The computer results are in reasonable agreement with the experimental data. Author

N92-15122* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
METHOD FOR PROVIDING REAL-TIME CONTROL OF A GASEOUS PROPELLANT ROCKET PROPULSION SYSTEM Patent
Brian G. Morris, inventor (to NASA) 12 Nov. 1991 14 p Filed 26 Jan. 1990 Supersedes N90-26073 (28 - 20, p 2825)
(NASA-Case-MSC-21542-1; US-Patent-5,063,734;
US-Patent-Appl-SN-470480; US-Patent-Class-60-204;
US-Patent-Class-60-240; US-Patent-Class-60-243;
US-Patent-Class-60-259; Int-Patent-Class-F02K-9/58) Avail: US Patent and Trademark Office CSCL 21H

The new and improved methods and apparatus disclosed provide effective real-time management of a spacecraft rocket engine powered by gaseous propellants. Real-time measurements representative of the engine performance are compared with predetermined standards to selectively control the supply of propellants to the engine for optimizing its performance as well as efficiently managing the consumption of propellants. A priority system is provided for achieving effective real-time management of the propulsion system by first regulating the propellants to keep the engine operating at an efficient level and thereafter regulating the consumption ratio of the propellants. A lower priority level is provided to balance the consumption of the propellants so significant quantities of unexpended propellants will not be left over at the end of the scheduled mission of the engine.
Official Gazette of the U.S. Patent and Trademark Office

N92-15123*# Alabama Univ., Huntsville. College of Engineering.
ENGINE DATA INTERPRETATION SYSTEM (EDIS), PHASE 2 Final Report, 30 Oct. 1990 - 29 Jul. 1991
Thomas L. Cost and Martin O. Hofmann Sep. 1991 82 p
(Contract NAS8-36955)
(NASA-CR-189501; NAS 1.26:189501; UAH-ME-91-101) Avail: NTIS HC/MF A05 CSCL 21H

A prototype of an expert system was developed which applies qualitative constraint-based reasoning to the task of post-test analysis of data resulting from a rocket engine firing. Data anomalies are detected and corresponding faults are diagnosed.

Engine behavior is reconstructed using measured data and knowledge about engine behavior. Knowledge about common faults guides but does not restrict the search for the best explanation in terms of hypothesized faults. The system contains domain knowledge about the behavior of common rocket engine components and was configured for use with the Space Shuttle Main Engine (SSME). A graphical user interface allows an expert user to intimately interact with the system during diagnosis. The system was applied to data taken during actual SSME tests where data anomalies were observed. Author

N92-15124*# Sverdrup Technology, Inc., Brook Park, OH.
MISSION AND SYSTEM OPTIMIZATION OF NUCLEAR ELECTRIC PROPULSION VEHICLES FOR LUNAR AND MARS MISSIONS Final Report
James H. Gilland Dec. 1991 16 p Presented at the 22nd International Electric Propulsion Conference, Viareggio, Italy, 14-17 Oct. 1991; sponsored by AIDAA, AIAA, DGLR, and JSASS
(Contract NAS3-25266)
(NASA-CR-189058; E-6659; NAS 1.26:189058; IEPC-91-038)
Avail: NTIS HC/MF A03 CSCL 21H

The detailed mission and system optimization of low thrust electric propulsion missions is a complex, iterative process involving interaction between orbital mechanics and system performance. Through the use of appropriate approximations, initial system optimization and analysis can be performed for a range of missions. The intent of these calculations is to provide system and mission designers with simple methods to assess system design without requiring access or detailed knowledge of numerical calculus of variations optimizations codes and methods. Approximations for the mission/system optimization of Earth orbital transfer and Mars mission have been derived. Analyses include the variation of thruster efficiency with specific impulse. Optimum specific impulse, payload fraction, and power/payload ratios are calculated. The accuracy of these methods is tested and found to be reasonable for initial scoping studies. Results of optimization for Space Exploration Initiative lunar cargo and Mars missions are presented for a range of power system and thruster options. Author

N92-15125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HIGH TEMPERATURE THRUSTER TECHNOLOGY FOR SPACECRAFT PROPULSION
Steven J. Schneider 1991 16 p Presented at the 42nd Congress of the International Astronautical Federation, Montreal, Quebec, 5-11 Oct. 1991 Previously announced in IAA as A92-13155
(NASA-TM-105348; E-6718; NAS 1.15:105348; IAF-91-254)
Avail: NTIS HC/MF A03 CSCL 21H

A technology program intended to develop high-temperature oxidation-resistant thrusters for spacecraft applications is considered. The program will provide the requisite material characterizations and fabrication to incorporate iridium coated rhenium material into small rockets for spacecraft propulsion. This material increases the operating temperature of thrusters to 2200 C, a significant increase over the 1400 C of the silicide-coated niobium chambers currently used. Stationkeeping class 22 N engines fabricated from iridium-coated rhenium have demonstrated steady state specific impulses 20-25 seconds higher than niobium chambers. These improved performances are obtained by reducing or eliminating the fuel film cooling requirements in the combustion chamber while operating at the same overall mixture ratio as conventional engines. Author

N92-15126# Los Alamos National Lab., NM.
PRELIMINARY COMPUTATIONAL INVESTIGATION OF AN OPEN CYCLE GAS CORE ROCKET
S. D. Howe and R. L. Bowers 1991 12 p Presented at the AIAA/NASA/OAI Conference on Advanced Space Exploration Initiative (SEI) Technologies, Cleveland, OH, 3-4 Sep. 1991
(Contract W-7405-eng-36)
(DE92-000315; LA-UR-91-2861; AIAA-91-3516; CONF-9109226-20) Avail: NTIS HC/MF A03

Recent studies and reviews by several national level committees have identified nuclear propulsion systems as necessary for the Space Exploration Initiative. Reducing the round trip time for a manned Mars mission has been recognized as a high priority. Although the solid core nuclear rocket provides a significantly higher performance than chemical propulsion, the gas core nuclear rocket could provide even better performance resulting in much shorter mission profiles. Initial assessment of gas core concepts may be possible using coupled computational models. We have initiated an assessment of some existing computer code capabilities and applied the codes to some preliminary geometries. Some results of both criticality and fluid flow calculations will be presented. DOE

N92-15127*# Sverdrup Technology, Inc., Brook Park, OH.
NEP MISSION SENSITIVITIES TO SYSTEM PERFORMANCE Final Report
James H. Gilland Dec. 1991 9 p Presented at the Ninth Symposium on Space Nuclear Systems, Albuquerque, NM, 12-16 Jan. 1992; sponsored by New Mexico Univ.
(Contract NAS3-25266)
(NASA-CR-189059; E-6660; NAS 1.26:189059) Avail: NTIS HC/MF A02 CSCL 21H

Nuclear Electric Propulsion (NEP) mission performance is strongly affected by system performance. Power and propulsion system specific mass, specific impulse, and efficiency all combine to determine the performance limits for a given mission. Thruster technology determines the specific impulse and efficiency of the system. The effects of these parameters on the mission performance of NEP systems relative to other concepts was analyzed to give guidance to thruster development goals for a range of missions: Lunar Cargo, Mars Cargo, and Mars Piloted. Mission sensitivities to system parameters are discussed, and technology requirements are identified for each mission. Author

N92-14982# Societe Europeenne de Propulsion, Vernon (France).
FUNDAMENTAL RESEARCH APPLIED TO COMBUSTION IN ROCKET ENGINES [RECHERCHE FONDAMENTALE APPLIQUEE A LA COMBUSTION DANS LES MOTEURS FUSEE]
P. A. Baudart, T. Delaporte, and P. Clavin (Centre National de la Recherche Scientifique, Marseilles, France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 81-85 In FRENCH (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-14983# Societe Europeenne de Propulsion, Vernon (France).
NUMERICAL SIMULATION OF IGNITION IN A CRYOGENIC ROCKET CHAMBER [SIMULATION NUMERIQUE DE L'ALLUMAGE D'UNE CHAMBRE DE MOTEUR FUSEE]
P. A. Baudart, P. Danous, T. Delaporte, V. Duthoit, and J. C. Harlay *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 87-92 In FRENCH Previously announced in IAA as A91-41743 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-14984# Societe Europeenne de Propulsion, Vernon (France).
SUPERSONIC COMBUSTION STUDIES [ETUDES EN COMBUSTION SUPERSONIQUE]
H. Zeller, D. Saucereau, and M. Desaulty (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Moissy-Cramayel, (France) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 93-100 In FRENCH (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15859*# Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Mechanical Engineering.
AN ASSESSMENT OF SECONDARY LOSS REDUCTION TECHNIQUES FOR STME LOX TURBINE
Mingking K. Chyu *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

N92-15860*# State Univ. of New York, Utica. Structures and Dynamics Lab.
AN OVERVIEW OF THE CURRENT TECHNOLOGY RELEVANT TO THE DESIGN AND DEVELOPMENT OF THE SPACE TRANSPORTATION MAIN ENGINE (STME)
Digendra K. Das *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

N92-15861*# Alabama Univ., Huntsville.
EXPERIMENTAL INVESTIGATION OF A SOLID ROCKET COMBUSTION SIMULATOR
Robert A. Frederick, Jr. *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

N92-15864*# Tennessee Technological Univ., Cookeville. Dept. of Mechanical Engineering.
IGNITION TRANSIENT ANALYSIS OF SOLID ROCKET MOTOR
Samuel S. Han *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

N92-15866*# Cincinnati Univ., OH. Dept. of Electrical and Computer Engineering.
ON THE DEVELOPMENT OF SYSTEM-THEORETIC TOOLS FOR THE DESIGN OF INTEGRATED HEALTH MONITORING AND CONTROLS FOR ROCKET PROPULSION SYSTEMS
Arthur J. Helmicki *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

N92-15877*# Tennessee Univ., Chattanooga. Mechanical Engineering-Mechanics.
REDESIGN OF FLIGHT SPACE SHUTTLE MAIN ENGINE NOZZLE G-15 SEAL AREA BASED ON THE THERMAL ANALYSIS AND FLOW MODELS
Gary H. McDonald *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

N92-15128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
TRIBOLOGICAL AND MECHANICAL COMPARISON OF SINTERED AND HIPPED PM212: HIGH TEMPERATURE SELF-LUBRICATING COMPOSITES
Christopher DellaCorte, Harold E. Sliney, and Michael S. Bogdanski (Case Western Reserve Univ., Cleveland, OH.) 1992 27 p Proposed for presentation at the Annual Meeting of the Society of Tribologists and Lubrication Engineers, Philadelphia, PA, 4-7 May 1992
(NASA-TM-105379; E-6592; NAS 1.15:105379) Avail: NTIS HC/MF A03 CSCL 07A

Selected tribological, mechanical and thermophysical properties of two versions of PM212 (sintered and hot isostatically pressed, HIPped) are compared. PM212, a high temperature self-lubricating composite, contains 70 wt percent metal bonded chromium carbide, 15 wt percent CaF2/BaF2 eutectic and 15 wt percent silver. PM212 in the sintered form is about 80 percent dense and has previously been shown to have good tribological properties from room temperature to 850 C. Tribological results of a fully densified, HIPped version of PM212 are given. They are compared to sintered PM212. In addition, selected mechanical and thermophysical properties of both types of PM212 are discussed and related to the tribological similarities and differences between the two PM212 composites. In general, both composites display similar friction and wear properties. However, the fully dense PM212 HIPped composite exhibits slight lower friction and wear than sintered PM212. This may be attributed to its generally higher strength properties. The sintered version displays stable wear properties over a wide load range indicating its promise for use in a variety of applications. Based upon their properties, both the sintered and HIPped PM212 have potential as bearing and seal materials for advanced high temperature applications. Author

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

For ceramic materials see *27 Nonmetallic Materials*.

N92-15129*# Old Dominion Univ., Norfolk, VA. Dept. of Mechanical Engineering and Mechanics.
TOUGHENING OF PMR COMPOSITES BY SEMI-INTERPENETRATING NETWORKS Final Report, period ended 30 Sep. 1991
S. N. Tiwari and K. Srinivasan Nov. 1991 30 p
(Grant NAG1-569)
(NASA-CR-189468; NAS 1.26:189468) Avail: NTIS HC/MF A03 CSCL 11D

Polymerization of monomer reactants (PMR-15) type polyimide and RP46 prepregs were drum wound using IM-7 fibers. Prepregging and processing conditions were optimized to yield good quality laminates with fiber volume fractions of 60 percent (+/- 2 percent). Samples were fabricated and tested to determine comprehensive engineering properties of both systems. These included 0 deg flexure, short beam shear, transverse flexure and tension, 0 deg tension and compression, intralaminar shear, short block compression, mode 1 and 2 fracture toughness, and compression after impact properties. Semi-2-IPN (interpenetrating polymer networks) toughened PMR-15 and RP46 laminates were also fabricated and tested for the same properties. Author

N92-15130# Los Alamos National Lab., NM.
INTERFACIAL FRACTURE TOUGHNESS OF ALUMINA/NIOBIUM SYSTEMS
M. G. Stout, N. P. ODowd, and C. F. Shih (Brown Univ., Providence, RI.) 1991 9 p Presented at the American Society of Mechanical Engineers (ASME) Annual Winter Meeting, Atlanta, GA, 1-6 Dec. 1991
(Contract W-7405-eng-36)
(DE92-000215; LA-UR-91-2975; CONF-911213-10) Avail: NTIS HC/MF A02

The interfacial fracture toughness of an alumina/niobium composite has been measured as a function of phase angle. The interface was formed by solid-state bonding bulk fine-grain alumina with a commercial purity niobium at 1600 C for 0.5 hr under a pressure of 10.5 MPa. The alumina/niobium system has a number of features which makes it ideal for an investigation of interfacial

fracture toughness. From High Resolution Electron Microscopy (HREM) data we estimate that the width of the interface is no more than 10 atomic planes. Furthermore the thermal expansion coefficients of the two materials differ by less than 5 percent so residual stresses due to the bonding process are small. Using symmetric and asymmetric four point bend specimens we have measured the fracture toughness of homogenous alumina and that of the alumina/niobium bimaterial in combinations of in-plane shear and tension. The fracture toughness of the homogenous alumina is relatively insensitive to the loading phase. The measured fracture toughness K(sub c) of the interface, however, depended strongly on phase angle. We were unable to obtain valid alumina/niobium interfacial toughness data at negative phase angles as the fracture initiates in the alumina and not at the interface. In symmetric bending at a phase angle approximately equal to 5 deg, we measured a nominal interface toughness of 4.0 MPa square root of m, comparable to the homogeneous alumina. We found that the toughness increased with loading phase angle to a value of K(sub c) approximately equal to 9 MPa square root of m at a phase between 25 deg and 40 deg. Preliminary calculations and experiments suggest that this effect is due to an asymmetric stress distribution, with respect to the interface, and plastic deformation in the niobium. DOE

N92-15131# Pacific Northwest Lab., Richland, WA.
A MODEL OF TOUGHENING EFFECTS IN WHISKER-REINFORCED COMPOSITES
R. G. Hoagland (Washington State Univ., Pullman.) and C. H. Henager, Jr. 1991 20 p
(Contract DE-AC06-76RL-01830)
(DE92-000226; PNL-SA-16936) Avail: NTIS HC/MF A03

A numerical approach is presented that lends itself to modeling the screening or antiscreening effects due solely to modulus differences of a discrete array of whiskers in an elastic matrix. The method is applied to single whiskers, and to examining the issue of whisker orientation of the toughness of ceramic composites. The model results indicate that crack-tip shielding due to modulus defect interactions occurs when the reinforcement has a higher modulus than the matrix material, and that anti-shielding occurs for the opposite case. Results for a single whisker located at the crack-tip (maximum effect) indicate that the crack-tip stress intensity is reduced by about 10 percent when a modulus ratio of four is assumed. Calculations performed with whisker arrays demonstrate pronounced effects of whisker orientation on the crack-tip screening, being larger for whiskers oriented perpendicular to the crack plane, as expected. Ordered whisker arrays produce larger and more uniform screening than do random whisker arrays. DOE

N92-15132# Oak Ridge National Lab., TN.
ON THE CAUSES OF COMPOSITIONAL ORDER IN THE NI(c)Pt(1-c) ALLOYS
B. L. Gyorffy, F. J. Pinski, B. Ginatempo (Messina Univ., Italy), and D. D. Johnson 1991 13 p Presented at the Adriatico Conference on Structural and Phase Stability of Alloys, Trieste, Italy, 21-24 May 1991
(Contract DE-AC05-84OR-21400)
(DE92-001974; CONF-9105270-1) Avail: NTIS HC/MF A03

We briefly review the arguments which gave rise to the current controversy concerning the origin of compositional order in Ni(c)Pt(1-c) alloys. We note that strain fluctuations play an important role in determining the state of compositional order in this system and outline a theoretical framework that takes account of them. DOE

N92-15133 National Physical Lab., Teddington (England). Div. of Materials Metrology.
MECHANICS FOR THE GROWTH OF BRIDGED CRACKS IN COMPOSITE MATERIALS
L. N. McCartney Jun. 1991 60 p
(NPL-DMM(A)-28; ISSN-0959-2423; ETN-92-90713) Copyright Avail: National Physical Lab., Teddington, TW11 OLW, England

The fracture mechanics are established for a large plate containing an embedded crack of finite length taking account of: the anisotropy of the material, the effect of residual stresses arising from isothermal temperature changes, and the effect of tractions applied to the crack surfaces resulting from the mechanical effect of crack bridging ligaments. An expression for the crack opening displacement distribution in terms of the crack bridging traction distribution is derived together with the corresponding fracture criterion based on energy considerations. It is shown how integral equations may be derived to solve bridged crack problems for both a linear and a nonlinear case. When the pre-existing crack is long enough, it is shown how a simple relation can be derived which controls the initiation of crack growth. The fracture mechanics analysis for long cracks is applied to three crack bridging problems: matrix cracking in perfectly bonded unidirectional composites, transverse cracking in perfectly bonded crossply laminates, matrix cracking in unidirectional composites where frictional slip occurs at fiber/matrix interfaces governed by the constant shear stress shear lag model of stress transfer. The fracture mechanics analysis is also applied to the three models of cracking in composites for the case when the pre-existing crack has finite length. A unique master curve is derived relating the cracking stress to the length of the pre-existing defect. For the third case of frictionally slipping interfaces in a unidirectional composite the relationship between the bridging tractions and the crack opening is nonlinear. Numerical solutions are obtained by iteration, and for longer crack lengths convergence problems have led to the need to use a quasi-linearization of the nonlinear integral equation. ESA

N92-15134# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.
IMPROVED TUNNEL RESISTANCE OF SILVERED-POLYMER MIRRORS
G. Jorgensen, P. Schissel, C. Kennedy, Y. Shinton, D. Powell, and J. Siebarth Oct. 1991 28 p
(Contract DE-AC02-83CH-10093)
(DE91-002200; NREL/TP-257-4419) Avail: NTIS HC/MF A03

This report documents the research performed at the Solar Energy Research Institute during fiscal year (FY) 1991 to develop ways to prevent delamination failure (known as tunneling) of silvered-polymer reflector materials. Several promising approaches have been identified and demonstrated that substantially reduce such failures. These approaches include (1) use of Tedlar edge tape rather than the manufacturer-recommended ECP-244 tape, (2) thermal treatment of laminated reflector/substrate constructions, and (3) application of silver to the polymer film through an alternative deposition process. Approaches 1 and 2 offer readily available engineering solutions to the delamination problem. Approaches 2 and 3 provide tunnel resistance over the entire surface of the reflector material, including the edges. Tedlar (a polyvinyl fluoride from DuPont) tape is an opaque white tape available in different widths from 3M Company. The base material has demonstrated outstanding outdoor durability. Thermal treatment of ECP-305 laminated to substrate materials has demonstrated outstanding resistance to tunneling. Alternative silver deposition techniques such as sputtering (rather than thermal evaporation) offer increased resistance to tunneling. DOE

N92-15135*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
DEVELOPMENT OF ADVANCED MODAL METHODS FOR CALCULATING TRANSIENT THERMAL AND STRUCTURAL RESPONSE
Charles J. Camarda Dec. 1991 114 p
(NASA-TM-104102; NAS 1.15:104102) Avail: NTIS HC/MF A06 CSCL 11D

Higher-order modal methods for predicting thermal and structural response are evaluated. More accurate methods or ones which can significantly reduce the size of complex, transient thermal and structural problems are desirable for analysis and are required for synthesis of real structures subjected to thermal and mechanical loading. A unified method is presented for deriving successively higher-order modal solutions related to previously-developed, lower-order methods such as the mode displacement and

mode-acceleration methods. A new method, called the force-derivative method, is used to obtain higher-order modal solutions for both uncoupled (proportionally-damped) structural problems as well as thermal problems and coupled (non-proportionally damped) structural problems. The new method is called the force-derivative method because, analogous to the mode-acceleration method, it produces a term that depends on the forcing function and additional terms that depend on the time derivatives of the forcing function. Author

N92-15136*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THERMALLY-DRIVEN MICROFRACTURE IN HIGH TEMPERATURE METAL MATRIX COMPOSITES
Subodh K. Mital (Toledo Univ., OH.) and Christos C. Chamis 1991 13 p Presented at the Symposium on the Mechanics of Composites at Elevated and Cryogenic Temperatures, ASME Applied Mechanics and Biomechanics Summer Conference, Columbus, OH, 16-19 Jun. 1991
(NASA-TM-105305; E-6657; NAS 1.15:105305) Avail: NTIS HC/MF A03 CSCL 11D

Microfracture (fiber/matrix fracture, interphase debonding and interply delamination) in high temperature metal matrix composites (HTMMC), subjected to thermal loading, is computationally simulated. Both unidirectional and crossply SiC/Ti15 composites are evaluated for microfracture driven by thermal loads, using multicell finite element models. Results indicate that under thermal loads alone, microfracture propagation is not as sensitive as it is under mechanical loads. Author

N92-15137*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EFFECTS OF A NONCOPLANAR BIPHENYLDIAMINE ON THE PROCESSING AND PROPERTIES OF ADDITION POLYIMIDES
Kathy C. Chuang, Raymond D. Vannucci, and Brad W. Moore (Akron Univ., OH.) 1992 4 p Proposed for presentation at the 203rd National Meeting of the American Chemical Society Symposium on Advances in Polymer Matrix Composites, San Francisco, CA, 5-10 Apr. 1992
(NASA-TM-105383; E-6720; NAS 1.15:105383) Avail: NTIS HC/MF A01 • CSCL 11D

Addition curing polyimides, prepared from noncoplanar 2,2'-bis(trifluoromethyl) 4,4' diaminobiphenyl (BTDB) with various dianhydrides were evaluated as high temperature polymer matrix materials. T sub g of these polymers were measured by mechanical methods as well as by thermal mechanical analysis. Physical and mechanical properties as well as the thermo-oxidative stability of neat resins and the corresponding G40-600 graphite fiber reinforced composites were compared to that of PMR-II-50 and V-CAP-75. Author

N92-15895*# Washington Univ., Saint Louis, MO. Dept. of Civil Engineering.
A STATISTICAL MODEL OF CARBON/CARBON COMPOSITE FAILURE
Kerry T. Slattery *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N92-15138# Language Services, Knoxville, TN.
REMOVAL OF METAL IONS FROM AQUEOUS SOLUTION BY ELECTRODIALYSIS
Yoshiyuki Miyagi, Tomokazu Tabatake, Tosha Kataoka, and Kimiyasu Sato (Tosoh Corp., Yamaguchi, Japan) 1991 13 p Prepared for Oak Ridge Y-12 Plant, TN
(Contract DE-AC05-84OS-21400)
(DE91-018439; Y/TR-91/21) Avail: NTIS HC/MF A03

A method is described for removing metal ions by electrodialysis. This method is characterized by dosing an aqueous solution containing metal ions (using a chelating agent), allowing chelated compounds of specific metal ions to form in the aqueous solution, and then removing the ions that cannot be accommodated by the chelate formation from the aqueous solution. Those ions not accommodated by the chelate formation are metal ions of valence 1. DOE

N92-15139# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
AMBIENT PRESSURE SYNTHESIS OF TERNARY GROUP (5) NITRIDES Technical Report No. 13, 1990 - 1991
P. E. Rauch and F. J. DiSalvo 16 Sep. 1991 16 p
(Contract N00014-91-J-1269)
(AD-A241201) Avail: NTIS HC/MF A03 CSCL 07/2

We describe the ambient pressure synthesis of MTaN2 (M=Na or K), and the previously unreported, isostructural niobium analogs by the use of an ammonia flow system, starting with either Ta3N5 or tantalum metal, or either NbN or niobium metal, respectively, and an excess of the alkali metal amide at 500 C. The products are characterized by X-ray powder diffraction. In addition, we describe our attempts to deintercalate NaTaN2 using NO2PF6. Ternary nitrides are a relatively unexplored class of compounds. In most of the known ternary alkali metal nitrides, the alkali metal is lithium. Many compounds with layered structures show intercalation/deintercalation chemistry. For example, many of the transition metal dichalcogenides are easily intercalated by alkali metals, subsequently these compounds are then easily deintercalated with simple oxidizing agents, such as iodine. GRA

N92-15140# Department of the Navy, Washington, DC.
MATERIAL AND METHOD FOR FAST GENERATION OF HYDROGEN GAS AND STEAM Patent Application
Woodrow W. Lee, inventor (to Navy) 20 Jun. 1991 24 p
(AD-D015049; US-Patent-Appl-SN-718123) Avail: NTIS HC/MF A03 CSCL 07/4

This invention relates to the production of hydrogen and heat energy and more particularly to the production of hydrogen and heat energy by reacting a metal with water. It has been proposed to replace conventional hydrocarbon fuels with cleaner burning hydrogen in internal combustion engines. Unfortunately existing methods of storing hydrogen require heavy tanks for the compressed gas or complicated vessels for the liquid that are uneconomical to use. The metal hydride, although it can be claimed as the best existing method of storing hydrogen, is still too heavy to be used as a mobile hydrogen storage medium. Additionally, the large stored quantities of hydrogen require special safety precautions. GRA

N92-15141# Mohammed V Univ., Rabat (Morocco). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF MOLYBDIC MEDIUM AND OF RARE EARTH MOLYBDATES IN SOLUTION Ph.D. Thesis
A. Bouih Apr. 1989 82 p In FRENCH
(DE91-637720; INIS-mf-12879) Avail: NTIS HC/MF A05

A potentiometric study of the molybdicmedium is discussed. Additionally, trivalent Europium behavior in this medium is investigated. The use of potentiometric data resulting from the molybdic medium study has enabled the determination, with the help of a computer program using electroneutrality equations and mass conservation, of the equilibrium constants corresponding to the polymerization of molybdic acid. The behavior of trivalent Europium in the molybdic medium has been investigated using solvent extraction and potentiometry methods. DOE

N92-15142# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.

AN ELECTRICAL NETWORK ANALOGOUS TECHNIQUE FOR MEASURING THERMOPHYSICAL PROPERTIES OF CONDUCTIVE MATERIALS

M. G. Ortiz, S. M. Freed, and M. A. Gosswiller 1990 18 p Presented at the 12th European Conference on Thermophysical Properties: Vienna (Austria), 24-28 Sep. 1990

(Contract DE-AC07-76ID-01570)

(DE91-018714; EGG-M-90257; CONF-900971-3) Avail: NTIS HC/MF A03

In this novel measurement technique, a sample of conducting continuous material is modeled as an electrical network. The electrical resistance of the sample is measured between several selected locations on its surface, which are reflected in the network model as outer leads. The model yields a set of non-linear algebraic equations in which the right hand side corresponds to an experimental external measurement of resistance. The solution of the system yields a mapping of the electrical resistance throughout the material sample. A carefully controlled calibration process identifies the dependence of electrical resistance on temperature for the specific material sample. The sample is then subjected to heating or cooling to generate a non-uniform temperature distribution within it. The electrical resistance is then measured as a function of time, and in steady state. The solution of the network equations provides a spatial mapping of the electrical resistance and thus the temperature of the sample, both as a function of time, and in steady state. These measurements provide enough information to evaluate the thermal conductivity of the material sample as a function of space and temperature. The technique is particularly suited for composite non-isotropic materials, material samples of irregular shape, and materials for high temperature applications, where such measurements are otherwise very difficult. A selected exploratory experiment and the corresponding calculations are presented to demonstrate the technique's feasibility and accuracy. DOE

N92-15143# International Centre for Theoretical Physics, Trieste (Italy).

THRESHOLD FREQUENCY FOR THE IONIC SCREENING OF ELECTRIC FIELDS INSIDE ELECTROLYTIC SOLUTIONS

J. R. deXammarOro, J. R. Grigera, F. Vericat (La Plata Univ., Argentina), and G. Ruderman Oct. 1990 16 p

(DE91-625524; IC-90/368) Avail: NTIS HC/MF A03

The ionic screening of electric fields inside electrolytic solutions is studied. We report two methods for the direct evaluation of the Maxwell frequency for a series of aqueous solutions of electrolytes. Our results confirm that the expression for the Maxwell threshold frequency also holds for electrolyte solutions. Attention is drawn to the importance of considering the existence of a threshold frequency when dealing with charged macromolecules, enzyme reactions and any other problem when mobile charges interact in electrolyte solutions. DOE

N92-15144# International Centre for Theoretical Physics, Trieste (Italy).

SCREENING IN DENSE IONIC FLUIDS

M. P. Tosi Jan. 1991 11 p

(DE91-641981; IC-91/1) Avail: NTIS HC/MF A03

There has been great progress in recent years in determining and understanding the structure of molten salts. I focus on molten alkali halides and discuss two main points concerning their liquid structure and its relationship with static electrical response in these dense ionic conductors. These points are the nature of screening and the related definitions and properties of the screening length and of the dielectric function, and developments in integral equation techniques for the evaluation of molten salt structure and static screening from given pair potentials. DOE

N92-15145# International Centre for Theoretical Physics, Trieste (Italy).

ON THE IONIC EQUILIBRIUM BETWEEN COMPLEXES IN MOLTEN FLUOROALUMINATES

Z. Akdeniz, K. Tankeshwar, and M. P. Tosi Feb. 1991 9 p

(DE91-641982; IC-91/27) Avail: NTIS HC/MF A02

We discuss theoretically the effect of the alkali cation species on the ionic equilibrium between AlF6 (exp 3-) and AlF4 (exp -) complexes in molten alkali fluoroaluminates, and the possible presence of AlF5 (exp 2) complexes in molten cryolite, in relation to very recent Raman scattering experiments by Gilbert and Materne. DOE

N92-15146# International Centre for Theoretical Physics, Trieste (Italy).

LIQUID STRUCTURE AND MELTING OF TRIVALENT METAL CHLORIDES

M. P. Tosi, G. Pastore, M. L. Saboungi, and D. L. Price (Argonne National Lab., IL.) Mar. 1991 18 p

(DE91-641983; IC-91/55) Avail: NTIS HC/MF A03

Many divalent and trivalent metal ions in stoichiometric liquid mixtures of their halides with alkali halides are fourfold or sixfold coordinated by halogens into relatively long-lived 'complexes'. The stability of these local coordination states and the connectivity that arises between them in the approach to the pure polyvalent metal halide melt determines the character of its short-range and possible intermediate-range order. The available evidence on local coordination in some 140 mixtures has been successfully classified by a structure sorting method based on Pettifor's chemical scale of the elements. Within the general phenomenological frame provided by structure sorting, main attention is given in this work to the liquid structure and melting mechanisms of trivalent metal chlorides. The liquid structure of YCl3 is first discussed on the basis of neutron diffraction measurements and of calculations within a simple ionic model, and the melting mechanisms of YCl3 snd AlCl3, which are structurally isomorphous in the crystalline state, are contrasted. By appeal to macroscopic melting parameters and transport coefficients and to liquid structure data on SbCl3, it is proposed that the melting mechanisms of these salts may be classified into three main types in correlation with the character of the chemical bond. DOE

N92-15147# Oak Ridge National Lab., TN.

ATOMIC SPECTROSCOPY WITH LASER AND SYNCHROTRON RADIATION

P. vandeMeulen, E. deBeer, C. A. deLange, and N. P. C. Westwood (Amsterdam Univ., Netherlands) 1991 15 p Presented at the Joint Meeting on Synchrotron Radiation and Dynamics Phenomena, Grenoble (France), 9-13 Sep. 1991

(Contract DE-AC05-84OR-21400)

(DE92-000670; CONF-910937-1) Avail: NTIS HC/MF A03

Oxygen and nitrogen atoms which play a crucial role in many chemical processes are studied with photoelectron spectroscopy. In the case of oxygen, synchrotron radiation is employed to study the inner-valence excitation region between 20 and 30 eV, and detailed information about bound-continuum interactions between discrete Rydberg levels and various ionization continua is obtained. In the case of nitrogen, laser multiphoton ionization is employed to study extensive novel Rydberg series below the lowest ionization energy which show appreciable local perturbations arising from bound-bound interactions. DOE

N92-15148# California Univ., Berkeley. Lawrence Berkeley Lab.

TWO-DIMENSIONAL NUCLEAR MAGNETIC RESONANCE STUDIES OF MOLECULAR STRUCTURE IN LIQUIDS AND LIQUID CRYSTALS Ph.D. Thesis

S. P. Rucker Jul. 1991 205 p

(Contract DE-AC03-76SF-00098)

(DE92-000959; LBL-31122) Avail: NTIS HC/MF A10

Magnetic couplings between protons, such as through-space dipole couplings and scalar J-couplings, depend sensitively on the structure of the molecule. Two dimensional nuclear magnetic resonance experiments provide a powerful tool for measuring these couplings, correlating them to specific pairs of protons within the molecule, and calculating the structure. This work discusses the

development of NMR methods for examining two such classes of problems: determination of the secondary structure of flexible molecules in anisotropic solutions; and primary structure of large biomolecules in aqueous solutions. DOE

N92-15149# Sandia National Labs., Albuquerque, NM.
MULTIVARIATE CALIBRATION APPLIED TO THE QUANTITATIVE ANALYSIS OF INFRARED SPECTRA
D. M. Haaland 1991 9 p Presented at the 8th International Conference on Fourier Tranform Spectroscopy, Lubeck-Travemunde (Germany), 1-6 Sep. 1991
(Contract DE-AC04-76DP-00789)
(DE92-001705; SAND-91-0242C; CONF-9109297-1) Avail: NTIS HC/MF A02

Multivariate calibration methods are very useful for improving the precision, accuracy, and reliability of quantitative spectral analyses. Spectroscopists can more effectively use these sophisticated statistical tools if they have a qualitative understanding of the techniques involved. A qualitative picture of the factor analysis multivariate calibration methods of partial least squares (PLS) and principal component regression (PCR) is presented using infrared calibrations based upon spectra of phosphosilicate glass thin films on silicon wafers. Comparisons of the relative prediction abilities of four different multivariate calibration methods are given based on Monte Carlo simulations of spectral calibration and prediction data. The success of multivariate spectral calibrations is demonstrated for several quantitative infrared studies. The infrared absorption and emission spectra of thin-film dielectrics used in the manufacture of microelectronic devices demonstrate rapid, nondestructive at-line, and in-situ analyses using PLS calibrations. Finally, the application of multivariate spectral calibrations to reagentless analysis of blood is presented. We have found that the determination of glucose in whole blood taken from diabetics can be precisely monitored from the PLS calibration of either mid- or near-infrared spectra of the blood. Progress toward the non-invasive determination of glucose levels in diabetics is an ultimate goal of this research. DOE

N92-15150# Ceramphysics, Inc., Westerville, OH.
A MINIATURE INEXPENSIVE, OXYGEN SENSING ELEMENT
R. W. Arenz Oct. 1991 106 p
(Contract DE-FG01-88CE-15401)
(DE92-001884; DOE/CE-15401/T13) Avail: NTIS HC/MF A06

An exhaustive study was conducted to determine the feasibility of Nernst-type oxygen sensors based on ceramics containing Bi2O3. The basic sensor design consisted of a ceramic sensing module sealed into a metal tube. The module accommodated an internal heater and thermocouple. Thermal expansion matched metals, adhesives, and seals were researched and developed, consistent with sequential firings during sensor assembly. Significant effort was devoted to heater design/testing and to material compatibility with Pt electrodes. A systematic approach was taken to develop all sensor components which led to several design modifications. Prototype sensors were constructed and exhaustively tested. It is concluded that development of Nernst-type oxygen sensors based on Bi2O3 will require further effort and application of specialized technologies. However, during the course of this 3-year program much progress was reported in the literature on amperometric-type oxygen sensors, and a minor effort was devoted here to this type of sensor based on Bi2O3. These studies were made on Bi2O3 based ceramic samples in a multilayer capacitor type geometry and amperometric type oxygen sensing was demonstrated at low temperatures, approximately equal to 160 C. A central advantage here is that these types of sensors can be mass-produced very inexpensively, approximately 20-50 cents per unit. Research is needed, however, to develop an optimum diffusion limiting barrier coating. In summary, the original goals of this program were not achieved due to unforeseen problems with Bi2O3 based Nernst sensors. However, a miniature amperometric sensor based on Bi2O3 was demonstrated in this program, and it is now seen that this latter sensor is far superior to the originally proposed Nernst sensor. DOE

N92-15151# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
EFFECT OF COMPROPORTIONATION ON THE VOLTAMMETRIC REDUCTION OF METHYL VIOLOGEN IN LOW IONIC STRENGTH SOLUTIONS Technical Report No. 3, period ending 1 Jan. 1991
John D. Norton and Henry S. White 10 Nov. 1991 18 p
(Contract N00014-91-J-1927)
(AD-A242444) Avail: NTIS HC/MF A03 CSCL 07/4

A variety of electrochemical methods are available for investigating homogeneous chemical reactions coupled to an initial electron-transfer step. Frequently, these methods are based on varying the mass-transfer rate(s) of reactant or intermediate(s) relative to the rate of chemical reaction. In a recent report, we proposed a new general method using microelectrodes, in low ionic strength solutions, that allows controlled variation of the mass transfer coefficients of charged reactants and intermediates through the influence of electric fields. This strategy was employed in a preliminary investigation of electron transfer reactions. GRA

N92-15152# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
REFLECTION AND TRANSMISSION OF WAVES FROM AN INTERFACE WITH A PHASE-TRANSFORMING SOLID
Rohan Abeyaratne and James K. Knowles Sep. 1991 32 p Prepared in cooperation with MIT, Cambridge, MA
(Contract N00014-90-J-1871)
(AD-A242455; TR-6) Avail: NTIS HC/MF A03 CSCL 20/1

This paper is concerned with waves in a composite elastic bar, the left half of which is composed of a linearly elastic material, while the nonlinearly elastic material of the right half can undergo a phase transition. We assume that a wave in the left portion of the bar is incident upon the interface between the two materials, and we investigate the question of whether the phase transition can be exploited to augment or diminish the strength of the reflected or transmitted wave. GRA

N92-15153# Chemical Research and Development Center, Aberdeen Proving Ground, MD.
CHROMATOGRAPHIC SEPARATION METHOD FOR THE SIMULANT MIXTURE OF TRIISOPROPYL PHOSPHITE AND BIS(2-ETHYLHEXYL) HYDROGEN PHOSPHITE Final Report, Mar. - May 1989
Patrick C. Mitchell, Michael W. Ellzy, L. G. Janes, Irwin Master, and Linda L. Szafraniec Aug. 1991 18 p
(AD-A242466; CRDEC-TR-296) Avail: NTIS HC/MF A03 CSCL 07/3

A simulant mixture has been devised for the Bigeye Fill Close Facility. The ability to analyze for the proposed simulant mixture has called upon an assay analysis for purity. The purity evaluation of triisopropyl phosphite (TIP), bis-(2-ethylhexyl) hydrogen phosphite (BIS), and mixtures of these two compounds is to be performed with gas chromatographic (GC) separation, using thermal conductivity detection (TCD). A natural impurity within the TIP is that of diisopropyl hydrogen phosphite (DIP) that could yield an error in the purity results if coelution with TIP occurs. Using a glovebox, investigators transferred samples of TIP, BIS, and DIP to sample vials under a nitrogen blanket. Additional samples were transferred to tubes in a similar manner for evaluation by Fourier Transform (FT) nuclear magnetic resonance (NMR). The primary method of evaluation was to make individual injections of these chemicals, along with mixture injections of TIP/DIP and TIP/BIS to obtain suitable chromatographic separations of the components. The methods' development involved evaluating instrumental parameters using megabore GC columns. GRA

N92-15154# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
ELECTRON CONDUCTION IN ORGANIC SOLUTIONS Technical Report No. 2, period ending 1 Jan. 1991
John D. Norton, Scott A. Anderson, and Henry S. White 10 Nov. 1991 17 p

(Contract N00014-91-J-1927)
(AD-A242500) Avail: NTIS HC/MF A03 CSCL 07/4

A voltammetric study of electron conduction in nitrobenzene (NB)/toluene solutions is presented. Analysis of steady-state mass transport limited currents corresponding to the first and second one-electron reductions of NB (to the radical anion, NB-, and dianion, NB-2, respectively) indicates that electrogeneration of NB-2 is suppressed to negligible values in concentrated NB solutions as a result of the increased flux of electrons away from the electrode surface via the self-exchange electron-transfer mechanism. Electrical conduction in nonmetallic liquids occurs by diffusion, migration, and convection of charged species. As early as 1966, it was proposed by Levich that in addition to these mechanisms, self-exchange electron-transfer reactions involving a reversible electroactive couple, can enhance the apparent transport of A and A- in a potential gradient. This type of charge transport has been the focus of numerous investigations during the past decade concerned with thin films containing fixed-site redox centers. In these systems, transport occuring by electron hopping has been shown to be equivalent to diffusion migration of the immobilized redox centers with an apparent diffusivity. GRA

N92-15155# Ballistic Research Labs., Aberdeen Proving Ground, MD.
ELECTROTHERMAL-CHEMICAL MODELING AND DIAGNOSTICS WORKSHOP, VOLUME 2 Final Report
Gloria P. Wren and Sharon L. Richardson Oct. 1991 417 p
Workshop held in Aberdeen Proving Ground, MD, 9-11 Jul. 1991
(AD-A242573; BRL-SP-92-Vol-2) Avail: NTIS HC/MF A18
CSCL 19/6

This report contains the abstracts and viewgraphs of the papers presented at the Joint Army, Navy, NASA, Air Force (JANNAF) workshop on Electrothermal-Chemical Modeling and Diagnostics, 9-11 July 1991, held at the U.S. Army Ballistic Research Laboratory. The topics include: Electrothermal Chemical (ETC) Gun Program, Diagnostics Development of an Upwind/Implicit Computational Model for the Advancement of Army ETC Guns, 30-MM ETC Ballistic Diagnostic Facility, Numerical Simulation of the Interior Ballistic Processes in an ETC Gun, Finite-Element Modeling of Electrothermal Chemical Guns, First Principles Modeling of a 60-MM ETC Gun Design, Physics of ETC Plasma Fluid Interactions, Observations and Modeling of Fundamental Electrothermal Gun Phenomena. GRA

N92-15156# Letterman Army Inst. of Research, San Francisco, CA.
A NEW METHOD FOR THE REDUCTION OF METHEMOGLOBIN AND METHEMOGLOBIN DERIVATIVES Final Report
Johannes Everse 3 Sep. 1991 30 p
(AD-A242578) Avail: NTIS HC/MF A03 CSCL 06/1

The chemical reduction of methemoglobin (metHb) with dithionite and other reducing agents has proven unsatisfactory due to undesirable byproducts. We have now developed a method to reduce methemoglobin on a preparative scale, in which metHb is reduced using photoactivated flavin mononucleotide (FMN). The reduction is performed in the absence of oxygen, since oxygen is reduced more rapidly than metHb and leads to the formation of H2O2. DL-methionine was routinely used as the electron donor, although a variety of compounds could act in this capacity. Thus, a 1 percent metHb solution containing 20 Mm DL-methionine and 20 micro mol FMN was reduced by more than 95 percent in 30 min using a 300-watt light bulb. The reaction rate depended on the methionine concentration as well as on the light intensity. The reaction was independent of pH between pH 6 and 8. GRA

N92-15157# Army Cold Regions Research and Engineering Lab., Hanover, NH.
OPERATORS MANUAL FOR DETERMINING MOLE PERCENT PURITY USING IMPURE Special Report
Dean Pidgeon and Patrick B. Black Aug. 1991 38 p
(AD-A242592; CRREL-SR-91-11; CETHA-TE-CR-91043) Avail: NTIS HC/MF A03 CSCL 14/2

This report presents the laboratory procedures and operation of the computer program IMPURE, which allows the operator to measure the mole percent purity of Standard Analytical Reference Materials (SARMs). Melting point temperature, freezing point depression and heat of fusion are measured by differential scanning calorimetry (DSC). These data are then used in van't Hoff's equation to determine molar purity. IMPURE was written to control the operation of the DSC and the analyses of the collected data according to American Society of Testing and Materials (ASTM) standards. GRA

N92-15158# Ballistic Research Labs., Aberdeen Proving Ground, MD.
EXCIMER LASER PHOTOCHEMICAL DECOMPOSITION OF DIMETHYLNITRAMINE Final Technical Report, Jun. 1990 - Jun. 1991
R. C. Sausa, M. J. McQuaid, A. W. Miziolek, and C. N. Merrow Oct. 1991 36 p
(DA Proj. 1L1-61102-AH-43)
(AD-A242664; BRL-TR-3280) Avail: NTIS HC/MF A03 CSCL 19/1

Cyclic nitramines such as HMX and RDX are energetic materials used in propellants and explosives. One of the keys to understanding the ignition and combustion of these compounds is a characterization of the pathways involved in their unimolecular decomposition. This information is difficult to obtain since the utility of energetic materials is based on their propensity to undergo extremely rapid, exothermic reactions. Moreover, functionally useful nitramines may decompose via a number of possible pathways, and secondary bimolecular reactions involving product radicals may obscure the identity of the initial reaction products. Because of these difficulties, dimethylnitramine (DMNA), (CH3)2NNO2, has been studied as a simple analog expected to exhibit some of the processes important in cyclic nitramine decomposition. DMNA decomposition has been investigated in thermal pyrolysis. GRA

N92-15159# National Inst. of Standards and Technology, Gaithersburg, MD.
SHORT-DURATION AUTOIGNITION TEMPERATURE MEASUREMENTS FOR HYDROCARBON FUELS Final Report, May 1989 - Sep. 1990
K. C. Smyth and N. P. Bryner Jan. 1991 49 p
(AD-A242816; AFESC/ESL-TR-90-43) Avail: NTIS HC/MF A03 CSCL 21/4

This study develops an experimental method for the reliable determination of auto ignition temperatures under a variety of conditions which involve short duration exposures of controlled fuel/air mixtures on three metal surfaces. Over 1100 autoignition temperature determinations have been made for the ignition of 15 hydrocarbons on heated nickel, stainless steel, and titanium surfaces for three different fuel/air mixtures. The measured autoignition temperatures generally decrease for the larger hydrocarbons and for richer mixtures, with the C2 hydrocarbons having particularly low values. The highest autoignition temperatures are observed for nickel surfaces and the lowest for the stainless steel, with titanium being an intermediate case. Relationships between autoignition, radical-based chemical mechanisms and end-gas autoignition (engine knock) are discussed. Most of the previous autoignition data are unsatisfactory since measurements are typically carried out using ASTM E659 test. This test method attempts to measure the autoignition temperature of hydrocarbons fuels in the gas-phase under experimental conditions where it is more likely that ignition temperatures for a complex mixture of the products of fuel decomposition are being determined rather than those of the original fuel. GRA

N92-15160# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
ISOTOPE ANALYSIS OF LITHIUM BY THERMIONIC MASS SPECTROMETRY
M. H. Kakazu and J. E. S. Sarkis Apr. 1991 19 p In

PORTUGUESE; ENGLISH summary
(DE91-641960; IPEN-PUB-334) Avail: NTIS HC/MF A03

An analytical mass spectrometric method for the isotope analysis of lithium has been studied. The analysis were carried out by using a single focusing thermoionic mass spectrometer Varian Mat TH5 with 90 degree magnetic sector field and 21.4 cm deflection radius, equipped with a dual Re-filament thermal ionization ion source. The effect of different lithium chemical forms, such as, carbonate, chloride, nitrate and sulfate upon the isotopic ratios Li-6/Li-7 has been studied. Isotopic fractionation of lithium was studied in terms of the time of analysis. The results obtained with lithium carbonate yielded a precision of plus or minus 0.1 percent and an accuracy of plus or minus 0.6, percent whereas with other chemical forms yielded precisions of plus or minus 0.5 percent and accuracies of plus or minus 2 percent. A fractionation correction factor, K=1.005, was obtained for different samples of lithium carbonate isotopic standard CBNM IRM 016, which has been considered constant. DOE

N92-15161*# Hydrogen Consultants, Inc., Littleton, CO.
INVESTIGATION OF LONG TERM STABILITY IN METAL HYDRIDES Final Report
Roger W. Marmaro, Franklin E. Lynch, Dhanesh Chandra, Steve Lambert, and Archana Sharma (Nevada Univ., Reno.) Nov. 1991 92 p Original contains color illustrations
(Contract NAS9-18175)
(NASA-CR-185667; NAS 1.26:185667) Avail: NTIS HC/MF A05; 2 functional color pages CSCL 07D

It is apparent from the literature and the results of this study that cyclic degradation of AB(5) type metal hydrides varies widely according to the details of how the specimens are cycled. The Rapid Cycle Apparatus (RCA) used produced less degradation in 5000 to 10000 cycles than earlier work with a Slow Cycle Apparatus (SCA) produced in 1500 cycles. Evidence is presented that the 453 K (356 F) Thermal Aging (TA) time spent in the saturated condition causes hydride degradation. But increasing the cooling (saturation) period in the RCA did not greatly increase the rate of degradation. It appears that TA type degradation is secondary at low temperatures to another degradation mechanism. If rapid cycles are less damaging than slow cycles when the saturation time is equal, the rate of hydriding/dehydriding may be an important factor. The peak temperatures in the RCA were about 30 C lower than the SCA. The difference in peak cycle temperatures (125 C in the SCA, 95 C in RCA) cannot explain the differences in degradation. TA type degradation is similar to cyclic degradation in that nickel peaks and line broadening are observed in X ray diffraction patterns after either form of degradation. Author

N92-15891*# Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering.
GROUP EVAPORATION
Hayley H. Shen *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21B

N92-15901*# Arkansas Univ., Fayetteville. Dept. of Mechanical Engineering.
COMPUTERIZED REDUCTION OF ELEMENTARY REACTION SETS FOR COMBUSTION MODELING
Carl V. Wikstrom *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21B

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N92-15162# Department of the Navy, Washington, DC.
COMPOSITION AND METHOD FOR PRODUCING AN ALUMINUM ALLOY RESISTANT TO ENVIRONMENTALLY-ASSISTED CRACKING Patent Application
John J. DeLuccia, inventor (to Navy) 15 Oct. 1990 16 p
(AD-D015044; US-Patent-Appl-SN-599557) Avail: NTIS HC/MF A03 CSCL 11/6

The present invention relates generally to aluminum alloys and more particularly to high-strength, molybdenum-containing, powder-derived aluminum alloys which have improved resistance to environmentally assisted cracking at room or moderately elevated temperatures. High-strength aluminum alloys, such as those in the 7000 series (Aluminum Association designation), are used extensively for structural aircraft components because of their combined lightness of weight and high strength. Generally speaking, these high-strength aluminum alloys suffer from poor resistance to environmentally-assisted cracking. For instance, when under load and subjected to a corrosive environment such as the sea water environment, these alloys are susceptible to stress corrosion cracking. GRA

N92-15163# California Univ., Berkeley. Lawrence Berkeley Lab.
EFFECT OF Au ON THE RELIABILITY OF FINE PITCH SURFACE MOUNT SOLDER JOINTS
J. Glazer (Hewlett-Packard Co., Palo Alto, CA.), P. Kramer, and J. W. Morris, Jr. May 1991 18 p Presented at the Surface Mount International (SMI) Conference, San Jose, CA, 27-29 Aug. 1991
(Contract DE-AC03-76SF-00098)
(DE92-000962; LBL-30881; CONF-9108172-1) Avail: NTIS HC/MF A03

The effect of Au on the reliability of 0.65 mm pitch surface mount solder joints between plastic quad flat packs and CuNiAu FR-4 printed circuit boards was investigated. CuNiAu is a desirable printed circuit board finish for multichip modules or printed circuit boards that would otherwise require a selective Au finish, such as edge connectors or wire bondable parts. However, Au is known to embrittle solder when it is present in sufficiently high concentrations, creating a concern that solder joint fatigue life in service will also be adversely affected. This paper reports the results of mechanical shock, mechanical vibration, and thermal cycling testing of fine pitch solder joints containing varying amounts of Au. Tests were performed on as soldered joints and on joints that had been heat treated to evolve the microstructure toward equilibrium. The tests were designed to accelerate in service conditions in a typical industrial environment. Under these conditions, the Au concentrations tested did not promote solder joint failures. Microstructural characterization of the distribution and morphology of the Au, Ni, and CuSn intermetallics in the joint before and after accelerated testing was also performed. On the basis of these observations it is recommended that the Au concentration in solder joints between plastic quad flat packs and CuNiAu FR-4 printed circuit boards not exceed 3.0 wt percent. DOE

N92-15164# Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.
SWELLING IN NICKEL - CARBON AND NICKEL - SILICON ALLOYS
M. A. Shaikh and K. Ehrlich Sep. 1990 39 p Prepared in cooperation with Kernforschungszentrum Karlsruhe GmbH, Fed. Republic of Germany
(DE91-625635; PINSTECH/NPD-128) Avail: NTIS HC/MF A03

In this report experimental results of a study of the effects of solute elements, carbon and silicon, on swelling in nickel irradiated with 100 KeV nickel ions to a dose of 18 dpa at 625 C, using transmission electron microscopy, are presented. Solute atoms

suppress formation of voids in nickel by reducing void nucleation rate. Silicon is found to be more effective than carbon. Effects of temperature in the range 475-675 C and of dose (9.9, 19.7 and 39 dpa) on swelling in nickel were also investigated. Void number density increases with increasing temperature, reaches a maximum and then decreases. Average void diameter increases with increasing temperature except for the lowest dose (9.9 dpa), where it remains constant above 575 C. Dislocation loops coexist with voids at 475 C and 525 C at dose of 9.9 dpa. Swelling increases with increasing temperature, reaches a maximum and then decreases. No voids were observed in Ni-3.6 percent at any temperature and dose. DOE

N92-15165# Lawrence Livermore National Lab., CA.
SUPERPLASTICITY IN A NICKEL SILICIDE ALLOY: MICROSTRUCTURAL AND MECHANICAL CORRELATIONS
S. L. Stoner, W. C. Oliver, and A. K. Mukherjee (California Univ., Davis.) 1991 11 p Presented at the International Conference on High Temperature Aluminides and Intermetallics, San Diego, CA, 17-19 Sep. 1991
(Contracts W-7405-eng-48; DE-AC05-84OR-21400)
(DE92-002160; UCRL-108170; CONF-910938-5) Avail: NTIS HC/MF A03

The superplastic properties of a nickel silicide based intermetallic alloy have been investigated as a function of strain, strain-rate, and temperature. The evolution of the microstructure during superplasticity, including grain growth, grain refinement, and cavitation, is reviewed. The relationship of the flow stress to strain and to strain-rate and the activation energy of the deformation process have been established. Finally, deformation mechanisms for superplasticity in the alloy at intermediate and high strain-rates are proposed. DOE

N92-15166# Oak Ridge National Lab., TN.
EFFECTS OF TEST ENVIRONMENT AND GRAIN SIZE ON THE TENSILE PROPERTIES OF L1(SUB 2)-ORDERED (Co,Fe)3V ALLOYS
C. Nishimura and C. T. Liu 1991 20 p Presented at the International Conference on High Temperature Aluminides and Intermetallics, San Diego, CA, 17-19 Sep. 1991
(Contract DE-AC05-84OR-21400)
(DE92-002332; CONF-910938-7) Avail: NTIS HC/MF A03

The influence of test environment, grain size, and heat treatment on the tensile properties and fracture behavior of L1 sub 2-ordered (Co78Fe22)3V and (Co85Fe15)3V alloys was studied at room temperature. The tensile ductility depends strongly on test environments; the elongation decreases in the sequence of oxygen, vacuum, air, and distilled water. The loss in elongation is accompanied by a change in fracture mode from transgranular to intergranular. When tested in oxygen or vacuum, (Co78Fe22)3V specimens exhibited predominantly transgranular fracture, while (Co85Fe15)3V specimens exhibited essentially intergranular fracture. Grain refinement of (Co78Fe22)3V resulted in a ductility improvement in air, while such a beneficial effect of a grain refinement was not observed in (Co85Fe15)3V. These results suggest that: (1) (Co,Fe)3V alloys exhibit a moisture-induced hydrogen embrittlement and (2) grain boundaries are more intrinsically brittle in (Co85Fe15)3V than in (Co78Fe22)3V. The presence of a brittle hexagonal phase is suggested to be the reason for the observed grain boundary brittleness in (Co85Fe15)3V. DOE

N92-15167# Los Alamos National Lab., NM.
THE HIGH-STRAIN-RATE AND SPALLATION RESPONSE OF TANTALUM, Ta-10W, AND T-111
G. T. Gray, III and A. D. Rollett 1991 14 p Presented at the Fall Meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals, Cincinnati, OH, 20-24 Oct. 1991
(Contract W-7405-eng-36)
(DE92-002446; LA-UR-91-3160; CONF-911003-20) Avail: NTIS HC/MF A03

The compressive true stress-true response of tantalum, Ta-10W, and T-111 were found to depend on the applied strain rate, in the range 0.001 to 7000/s. The strain rate sensitivities of the flow stress of tantalum, Ta-10W, and T-111 a 1 pct. strain are 0.062, 0.031, and 0.024, respectively. The rates of strain hardening in Tantalum, Ta-10W, and T-111 are seen to exhibit differing behavior with increasing strain rate. The calculated average strain hardening rate in tantalum, Theta, for the quasi-static (0.001/s) data at 25 C is 2080 MPa/unit strain. The hardening rate at 3000/s at 25 C decreases to 846 MPa/unit strain. Normalizing the work hardening rate in tantalum with the Taylor Factor for a random polycrystal, ((Theta)/(3.07) squared), yields work hardening rates of mu/276 at quasi-static strain rates and mu/680 at high rates, assuming a shear modulus of 61 GPa for tantalum at room temperature. While the work hardening of all the tantalum-based materials are similar at quasi-static rates, alloying results in a small reduction in hardening rate. With increasing strain rate, the work hardening rate in tantalum decreases by approximately a factor of two compared to the alloys. Alloying tantalum with substitutional or interstitial elements is thought to result in increased edge dislocation storage and screw dislocation cross-slip due to interactions with the alloying elements at high strain rates. DOE

N92-15168# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
A SCANNING TUNNELING MICROSCOPY INVESTIGATION OF THE ANNEALING OF THE Au(III) SURFACE Technical Report No. 5, period ending 1 Jan. 1991
Shelly R. Snyder 10 Nov. 1991 18 p
(Contract N00014-91-J-1927)
(AD-A242445) Avail: NTIS HC/MF A03 CSCL 07/2

This report describes how the quenching and annealing procedure can affect the formation and morphology of gold facets. We show that elastic and plastic deformations that occur in the AU sphere upon rapid cooling can propagate across the facet to produce highly ordered surface features and a periodicity of 60 Angstroms superimposed on automically flat terraces. The effects of annealing the gold sphere on this structure and the appearance of the surface reconstruction of gold are discussed. GRA

N92-15169# Army Armament Research, Development and Engineering Center, Watervliet, NY. Benet Lab.
FRACTURE TOUGHNESS TESTS AND DISPLACEMENT AND CRACK STABILITY ANALYSES OF ROUND BAR BEND SPECIMENS OF LIQUID-PHASE SINTERED TUNGSTEN Final Report
J. H. Underwood, F. I. Baratta, and J. J. Zalinka Oct. 1991 24 p
(AD-A242453; ARCCB-TR-91030) Avail: NTIS HC/MF A03 CSCL 11/6

Plane strain fracture toughness tests were performed using the recently proposed round bar bend test procedure with a liquid-phase sintered tungsten alloy. The tests included a direct comparison of fracture toughness from rectangular and round bend specimens and measurements of load line compliance using the unloading technique of J integral fracture tests. Complementary displacement and crack growth stability analyses of the round bar were performed as an extension of recent work in these two areas. GRA

N92-15170# Army Armament Research, Development and Engineering Center, Watervliet, NY.
FRACTAL CHARACTERIZATION OF METALLIC FRACTURE SURFACES Final Report
L. V. Meisel Sep. 1991 44 p
(AD-A242614; ARCCB-TR-91028) Avail: NTIS HC/MF A03 CSCL 11/6

Mandelbrot, Passoja, and Paullay defined the slit island method (SIM), established the fractal nature of fracture surfaces, and reported the negative correlation of fractal dimension D with fracture toughness in a selection of steel alloys in 1984. They also established for the steel samples studied the fractal dimension equivalent (within two percent) determined by SIM and Fourier

analysis of fracture surface profiles. In this report, with Mandelbrot's rule in mind, we employ the imprecise usage currently in vogue, i.e., we employ the same nomenclature and notations for fractal dimension of the fracture surface and of the curves bounding the islands produced by sectioning fracture surface and also for the fractional part of the fractal dimension. Serious questions have been raised regarding the fractal characterization of metallic fracture surfaces. The results of perimeter-area analysis and the slit island method (SIM), in particular, are cast into doubt. In this report, perimeter-area and perimeter-yardstick analyses of rectifiable curves and of mathematically constructed, simple fractal curves are presented in order to confront some questions in open literature. GRA

N92-15171# Dayton Univ., OH.
CALCULATION OF PHASE DIAGRAMS FOR METAL-GaAs SYSTEMS Interim Report, Jan. 1990 - Jan. 1991
James D. Scofield, Joseph E. Davison, and Steven R. Smith Oct. 1991 36 p
(Contract F33615-90-C-2036)
(AD-A242683; UDR-TR-91-76; WL-TR-91-2097) Avail: NTIS HC/MF A03 CSCL 20/4

This report describes the analytical methods utilized in the development of a computer model for the calculation of Metal-Ga-As ternary phase diagrams. The regular solution theory of alloying behavior has been used to model the free energy functions for the ternary systems of interest. Ternary phase diagrams for the Au, Ag, and Ge metals with GaAs have been calculated and are presented. The purpose of this work is to provide an analytical tool for use in determining the feasibility of candidate alloys for high temperature stability, when used as ohmic contacts to GaAs electronic devices. Subsequent work will be to empirically determine the accuracy and correctness of the computer model and the expansion to allow the addition of a fourth element and accurately model quaternary phase equilibrium diagrams involving GaAs semiconducting material. GRA

N92-15172# Technology Associates, Inc., Huntington Beach, CA.
METAL INJECTION MOLDING OF TUNGSTEN HEAVY ALLOYS: SBIR PHASE 1 Final Report, 20 Aug. 1990 - 20 Jun. 1991
Gary M. Allen Oct. 1991 41 p
(Contract DAAL04-90-C-0018)
(AD-A242742; MTL-TR-91-37) Avail: NTIS HC/MF A03 CSCL 11/6

The objective of this study is to investigate the feasibility of injection molding tungsten heavy alloys into net or near-net shape parts. The focus was to demonstrate that powder injection molding can provide parts with equivalent or superior sintered material properties to those that have been achieved for press/sintering heavy alloys of similar compositions. In addition, geometric shrinkage and key process variables were identified and analyzed. This investigation was divided into twelve tasks including elemental particle analysis using laser diffraction; powder blending; solid loading curve; feedstock rheology; feedstock mixing; prototype test mold; injection molding; furnacing (thermal debinding and sintering); and mechanical properties. GRA

N92-15173# Japan Atomic Energy Research Inst., Tokyo.
CREEP CURVE FORMULARIZATION AT 950 C FOR HASTELLOY XR
Yoshiyuki Kaji and Yasushi Muto (Japan Atomic Energy Research Inst., Tokai.) Mar. 1991 67 p In JAPANESE; ENGLISH summary
(DE91-508055; JAERI-M-91-023) Avail: NTIS HC/MF A04

Creep tests under constant stress were conducted on a nickel-base heat-resistant alloy, Hastelloy XR, in air at 950 C. Minimum creep strain rate, time to the onset of tertiary creep and time to rupture were obtained as a function of applied stress. Then, a creep constitutive equation was made based on the Garofalo formula for primary and secondary creep and based on the Kachanov-Rabotnov formula for tertiary creep, which could represent fairly well the experimental creep deformation curves under the constant stress conditions. The creep deformation under the constant load condition corresponding to the stress increment was analyzed using the creep constitutive equation and strain hardening law. Then the calculated creep strain showed slightly higher value than the experimental creep strain, and the calculated life was shorter than the experimental one. DOE

N92-15174# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
EUTECTIC MICROSTRUCTURES OF Al-ThAl3 AND Al-UAl4 ALLOYS
R. R. Vieira (Sao Paulo Univ., Brazil) and F. AmbrozioFilho 1990 12 p
(DE91-640100; INIS-BR-2616) Avail: NTIS HC/MF A03

This paper deals with the microstructures of systems Al-ThAl3 and Al-UAl4, which are composed by a non faceted phase (aluminum) and an intermetallic phase (ThAl3 or UAl4) which is normally a faceted phase. DOE

N92-15175# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
ANALYSIS OF HYDROGEN IN ZIRCONIUM METALLIC
A. N. Rodrigues and J. O. W. VegaBustillos Feb. 1991 14 p In PORTUGUESE; ENGLISH summary
(DE91-641970; IPEN-PUB-331) Avail: NTIS HC/MF A03

Determination of hydrogen in zirconium metallic have been performed using the hot vacuum extraction system and the gas chromatographic technique. The zirconium metallic samples were hydrieded by electrolitic techniques at different temperatures and times, then the samples were annealed at vacuum and etched by fluoridric acid solution. The details of the hydrieded process, analytical technique and the data obtained are discussed. DOE

N92-15176# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Desarrollo de Procesos.
PRODUCTION OF TITANIUM TETRACHLORIDE
P. M. Perillo and O. Botbol 1990 10 p In SPANISH; ENGLISH summary
(DE91-641980; CNEA-D-DP-FQP-305) Avail: NTIS HC/MF A02

This report presents a summary of results from the operation of laboratory scale production in batches of approximately 100 gs of titanium tetrachloride by chlorination with chloroform and carbon tetrachloride between 340 C and 540 C. Chlorination agent vapors were passed through a quartz column reacting with titanium oxide powder agglomerated in little spheres. Obtained titanium tetrachloride was condensed in a condenser, taken in a ballon and then purified by fractional distillation. The optimum temperature for chloroform was 400 C with 74 percent yield and 500 C for carbon tetrachloride with 69 percent yield. DOE

N92-15869*# Alabama A & M Univ., Huntsville. Dept. of Physics.
DISORDERING AND H-EMBRITTLEMENT OF Pb(110) SURFACE USING EMBEDDED ATOM METHOD AND MOLECULAR DYNAMICS
Majid Karimi *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11F

N92-15898*# California Polytechnic State Univ., San Luis Obispo. Materials Engineering.
CHARACTERIZATION OF THE CORROSION RESISTANCE OF BIOLOGICALLY ACTIVE SOLUTIONS: THE EFFECTS OF ANODIZING AND WELDING
Daniel W. Walsh *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summr Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11F

N92-15900*# Utah State Univ., Logan. Dept. of Industrial Technology.
HP9-4-.30 WELD PROPERTIES AND MICROSTRUCTURE
George W. Watt *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N92-15177# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
STRUCTURAL CHANGES IN CERAMICS YBa2Cu3O(7-x) UNDER Ar(EXP +7) IRRADIATION WITH ENERGY 46 MeV
S. L. Zajtsev (Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow, USSR), V. I. Lushchikov, V. K. Semina, and V. A. Skuratov 1989 6 p In RUSSIAN; ENGLISH summary
(DE91-638374; JINR-18-89-855) Avail: NTIS HC/MF A02

Structural changes in ceramics YBaCu3O(7-x) after Ar7(+) irradiation with the energy 46.3 MeV have been studied by X-ray diffraction. It is shown that the main part of the ceramic is transformed to an amorphous phase during ion irradiation up to 3 x 10(exp 14) sq cm without any new crystal phase formation. A superconducting phase, which remained after irradiation, exists in the form of recrystallized regions 400-500A in size. It is concluded that the degradation of critical parameters of yttrium high-temperature superconductors under heavy ion irradiation must be connected with ceramics amorphyzation but not with tetragonal transformation of the superconducting phase. DOE

N92-15178# Academy of Sciences (USSR), Leningrad. Inst. Yadernoj Fiziki.
INFLUENCE OF HIGH TEMPERATURE ANNEALING CONDITIONS ON ELECTRICAL PROPERTIES OF FAST NEUTRON IRRADIATED YBa2Cu3O(x) CERAMICS
R. F. Konopleva, I. V. Nazarkin, M. V. Chudakov, B. A. Borisov, A. N. Dyumin, V. M. Lebedev, and Yu. G. Lukyanov 1990 18 p In RUSSIAN; ENGLISH summary
(DE91-629786; LIYaF-1603) Avail: NTIS HC/MF A03

The temperature dependence of the specific resistance of the YBa2Cu3O(x) ceramics annealed in nitrogen atmosphere and in the air in temperature interval 100-950 C has been investigated. The restoration of the superconducting properties of unirradiated and fast reactor neutrons irradiated (F = 3.10(exp 17) cm(sup -2)) ceramic specimens, which was annealed in nitrogen atmosphere by T greater than or equal to 600 C was found. It was shown, that the character of the electron transfer in the normal phase in temperature region T 100 C is quasi-2-D and t temperatures close to T(sub c) (93 K less than T less than 100 K) the transfer occurs in the 3-D space. DOE

N92-15179# Technical Research Centre of Finland, Espoo. Metals Lab.
STRENGTH AND INTEGRITY OF CERAMIC COATINGS
Pertti Auerkari, Pentti Kauppinen, Kari Santaoja, and Tero Uuttu May 1991 22 p Sponsored by Technology Development Center Original contains color illustrations
(VTT-RR-734; ISBN-951-38-3982-6; ISSN-0358-5077; ETN-92-90676) Copyright Avail: NTIS HC/MF A03

The stiffness, stresses, and integrity of structures with porous ceramic coatings are considered in bending. The performance in comparison with that of bulk ceramic material, the failure criteria, and appropriate testing methods are discussed. Due to the low stiffness of porous ceramic layers, the Young's Modulus and elastic stresses are rarely obtained with sufficient accuracy from bending tests. Ultrasonic testing provides a nondestructive way of assessing Young's Modulus, with the possible additional advantage of information on anisotropy. Ultrasonic testing in C scan mode is also sentitive to defects originating and developing in the coating. The fracture toughness of a natural granite in the minimum toughness orientation was shown to be 1.2 +/- 0.05 MPa(square root of m), or about half of the typical reported values at random orientation. ESA

N92-15180# Oak Ridge National Lab., TN.
DIFFUSION-CONTROLLED PROCESSES IN MICROWAVE-FIRED OXIDE CERAMICS
M. A. Janney and H. D. Kimrey 1990 13 p Presented at the Spring Meeting of the Materials Research Society (MRS), San Francisco, CA, 16-21 Apr. 1990
(Contract DE-AC05-84OR-21400)
(DE92-002052; CONF-900466-103) Avail: NTIS HC/MF A03

Processing oxide-based ceramics using microwave heating leads to a number of unexpected results which can only be interpreted in terms of enhanced diffusion. Enhanced sintering has been observed in alumina and zirconia. Accelerated grain growth in dense, hot-pressed alumina has been demonstrated. Increased diffusion coefficients have been observed for diffusion of oxygen in sapphire. As yet, a satisfactory theory to account for these phenomena has not been developed. This paper reviews the experimental work conducted at the Oak Ridge National Laboratory during the past four years on the processing of oxides in both 2.45 and 28 GHz microwave furnaces. DOE

N92-15181# Artech Corp., Chantilly, VA.
SUPERHARD COATINGS FOR BEARINGS Final Report
Fred Ordway and Charles Feldman 5 Nov. 1990 55 p
(Contract DAAL04-88-C-0020)
(AD-A242476) Avail: NTIS HC/MF A04 CSCL 11/3

The object of the work to produce cubic boron nitride (cBN) coatings in types 17-4 and 440 stainless steel used in spherical rod end bearings. The coatings were formed on these and other substrates by ion-assisted physical vapor deposition. Infrared absorption spectra of coatings on silicon substrates showed the presence of the cubic modification of BN. Indentation measurements, by a special technique that separates the contribution of the film from that of the substrate, demonstrated high microhardness values. Motor-driven feedthroughs were installed in the vacuum chamber in preparation for the coating of spherical bearing components. Sample coupons submitted to the sponsor were found by a scratch test technique to show poor adhesion to the stainless steel. The remainder of the program was therefore devoted to improvement of the coating-substrate bond. Tensile bond strength values as high as 6,700 lb/sq in were attained. Some time after completion of the experimental work, however, it was found that the coatings were cracking into minute fragment and spalling off the substrates. The failure mechanism remains to be determined. GRA

N92-15182# Washington Univ., Saint Louis, MO. Dept. of Chemistry.
MECHANISM OF DNP-ENHANCED POLARIZATION TRANSFER ACROSS THE INTERFACE OF POLYCARBONATE/POLYSTYRENE HETEROGENEOUS BLENDS
Mobae Afeworki and Jacob Schaefer 14 Nov. 1991 31 p
(Contract N00014-90-J-4118)
(AD-A242570; TR-2) Avail: NTIS HC/MF A03 CSCL 11/9

The same integrated intensity is observed for the interface-polycarbonate (PC) signal in PC(13C)/polystyrene (PS) (12C/asterisk) and PC(13C)/PS(2D/asterisk) thin film blends in a DNP-difference experiment. This result proves that the dominant mechanism of polarization transfer from the electrons in the PS phase to the protons in the PC phase is by direct polarization transfer. The interface-PC signal intensity arises from a 60-A region which is 2 percent of the PC film thickness. Minor polarization transfer from the DNP-enhanced protons of PS to the PC protons across the PC/PS interface via H-H spin diffusion in PC(13C)/PS(12C/asterisk) may also occur. Even in BDPA-doped

homopolymers, the enhancement mechanism is mainly via direct solid-effect polarization transfer, a conclusion based on the similarity of the time dependence of the electron-proton polarization transfers for PS (asterisk) and PS(2D/asterisk). GRA

N92-15183# Washington Univ., Saint Louis, MO. Dept. of Chemistry.
MOLECULAR DYNAMICS OF POLYCARBONATE CHAINS AT THE INTERFACE OF POLYCARBONATE/POLYSTYRENE HETEROGENEOUS BLENDS
Mobae Afeworki and Jacob Schaefer 14 Nov. 1991 19 p
(Contract N00014-90-J-4118)
(AD-A242571; TR-3) Avail: NTIS HC/MF A03 CSCL 11/9

Having generated and identified a C-13 nuclear magnetic resonance (NMR) signal arising exclusively from polycarbonate (PC) chains the polycarbonate/polystyrene (PC/PS) interface, we can now perform NMR relaxation experiments to characterize the microscopic dynamics of these chains. A difference pulse sequence is used which includes a period for carbon dephasing under the influence of dipolar coupling to protons isolated from one another by multiple-pulse H-H decoupling. Thus, the full experiment involves monitoring the dephasing of DNP-enhanced C-13 NMR magnetization of interface PC chains in a thin-film PC/PS blend by dipolar rotational spin echo (DRSE) C-13 NMR. The results of DRSE experiments have been well established for the characterization of the molecular chain dynamics of synthetic polymers and proteins. GRA

N92-15184# Washington Univ., Saint Louis, MO. Dept. of Chemistry.
DIRECT ELECTRON-TO-CARBON POLARIZATION TRANSFER IN HOMOGENEOUSLY DOPED POLYCARBONATES
Mobae Afeworki, Shimon Vega, and Jacob Schaefer 14 Nov. 1991 34 p
(Contract N00014-90-J-4118)
(AD-A242572; TR-4) Avail: NTIS HC/MF A03 CSCL 07/6

A direct electron to carbon DNP solid effect polarization transfer is observed for the aromatic and carbonyl carbons of polycarbonate homogeneously doped with BDPA. The direct electron to carbon polarization transfer operates over a range of 30 to 60 A. Carbons that are closest to the free radicals are polarized first and have the longest spin-lattice relaxation times. Fourier transforms of time domain magnetization, synchronously detected under combined chemical shift and C-H dipolar interactions, show an asymmetrical sideband pattern in the dipolar frequency dimension. Simulations that qualitatively agree with the observed asymmetrical sideband patterns are obtained by assuming that molecular motion in the vicinity of the bulky free radical is reduced. GRA

N92-15185# Washington Univ., Saint Louis, MO. Dept. of Chemistry.
SELECTIVE OBSERVATION OF THE INTERFACE OF HETEROGENEOUS POLYCARBONATE/POLYSTYRENE BLENDS BY DYNAMIC NUCLEAR POLARIZATION C-13 NMR
Mobae Afeworki, Robert A. McKay, and Jacob Schaefer 14 Nov. 1991 44 p
(Contract N00014-90-J-4118)
(AD-A242574; TR-1) Avail: NTIS HC/MF A03 CSCL 11/9

Heterogeneous blends of polycarbonate and polystyrene were formed by serial film casting. The polystyrene phase of each blend was homogeneously doped with 2 percent by weight of a bisdiphenylenephenylallyl free radical complex with benzene. Proton polarization enhanced by dynamic nuclear polarization was generated in the polycarbonate phase by dipolar coupling to electrons in the polystyrene phase under 39-GHz microwave irradiation at the difference of the electron and proton Larmor frequencies. Proton magnetization was then transferred to carbons under matched, spin lock conditions for detection with chemical shift selectivity by magic-angle spinning C-13 nuclear magnetic resonance (NMR). The C-13 signal from polycarbonate arises exclusively from chains which are at the polycarbonate/polystyrene interface. Signals from bulk polycarbonate were suppressed by differencing techniques. Attempts at direct polarization transfers from electrons in the polystyrene phase to carbons in the polycarbonate phase failed. GRA

N92-15186# Kentucky Univ., Lexington. Dept. of Chemistry.
STUDIES ON MACROMOLECULES DERIVED FROM POLYPYRAZOLYLBORON AND RELATED BORON-NITROGEN SPECIES Final Report, Aug. 1983 - Sep. 1991
Kurt Niedenzu Oct. 1991 9 p
(Contract N00014-83-K-0611)
(AD-A242588) Avail: NTIS HC/MF A02 CSCL 07/3

Studies on the synthesis, characterization, and chemical behavior of pyrazaboles, semi-pyrazaboles, poly(1-pyrazolyl)borates, boroxins, diboroxanes, and borazines have been performed. Several pathways for the synthesis and chemical modification of pyrazaboles, which are characterized by the general framework and contain a central B2N4 heterocycle, have been developed. Besides normal pyrazaboles triply bridged derivatives with repeating and semi-pyrazaboles have been prepared and characterized, including a series of X-ray crystal structure determinations. Various polynuclear materials containing boron units (M=metal) and poly(1-pyrazolyl)borates have also been studied. Some corresponding derivatives of azoles other than pyrazole have been investigated highlighted by the preparation and characterization of a novel porphine analogue containing a B4N12 heterocycle. GRA

N92-15187# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
CATIONIC BULK POLYMERIZATION OF VINYL ETHERS IN THE LIQUID CRYSTALLINE PHASE
H. Jonsson, U. W. Gedde, A. Hult, and A. Percec 30 Oct. 1991 14 p
(Contract N00014-89-J-1828)
(AD-A242627; TR-53) Avail: NTIS HC/MF A03 CSCL 07/3

Cationic bulk polymerization of liquid crystalline phenyl benzoate and biphenyl vinyl ethers was performed using either thermal or photochemical initiation by onium salts. High molecular mass polymers having narrow molecular mass distribution were produced in high yields at very high temperature. Seemingly, the polymerization system could stabilize the growing species and thus, reduce the amount of chain transfer reactions. Thin films of the monomers were oriented in their liquid crystalline state by the use of conventional ordering techniques used for low molar mass liquid crystals. On subsequent polymerization, the orientation was preserved giving liquid crystalline thin films having a very high degree of order. GRA

N92-15188# University of Southern California, Los Angeles. Dept. of Chemical Engineering.
THE BEHAVIOR OF POLYMERS FILLED WITH MONODISPERSE POLYMERIC BEADS Final Report, 1 May 1988 - 14 Aug. 1981
Ronald Salovey and John J. Aklonis 4 Nov. 1991 4 p
(Contract N00014-88-K-0302)
(AD-A242732) Avail: NTIS HC/MF A01 CSCL 07/6

Techniques have been developed for preparing crosslinked spherical polymer beads, monodisperse in size, composed of polystyrene and derivatives, polymethyl methacrylate (PMMA), polyethyl methacrylate, polybutyl methacrylate and polymethyl acrylonitrile. Control of the crosslink density gradient was achieved by semi-continuous copolymerization. Monodisperse bead diameters are controlled between 150-800 nm in a single stage synthesis, with sizes reproducible to +/- 5 nm in a given run and crosslink densities vary from 1-20 mol percent. Particle nucleation onto preexisting polymer seeds was conducted in a multistage polymerization yielding compositionally complex beads up to 4 microns in diameter. Beads are characterized by a wide variety of techniques. A new procedure has been developed to determine the crosslink density by equilibrium swelling on an ultrafiltration membrane. GRA

N92-15189*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AN ANALYSIS OF LDEF-EXPOSED SILVERED FEP TEFLON THERMAL BLANKET MATERIAL
Philip R. Young and Wayne S. Slemp Dec. 1991 28 p
(NASA-TM-104096; NAS 1.15:104096) Avail: NTIS HC/MF A03 CSCL 11C

The characterization of selected silvered fluorinated ethylene propylene (FEP) teflon thermal blanket material which received 5 years and 9 months of exposure to the LEO environment on the Long Duration Exposure Facility is reported. X-ray photoelectron spectroscopy, infrared, and thermal analyses did not detect a significant change at the molecular level as the result of this exposure. However, various microscopic analyses revealed a roughening of the coating surface due to atomic oxygen erosion which resulted in some materials changing from specular reflectors of visible radiation to diffuse reflectors. The potential effect of silicon-containing molecular contamination on these materials is addressed. Author

N92-15190*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STRUCTURE-PROPERTY STUDY OF KETO-ETHER POLYIMIDES
James F. Dezern and Catharine I. Croall (Lockheed Engineering and Sciences Co., Hampton, VA.) Dec. 1991 15 p
(NASA-TM-104178; NAS 1.15:104178) Avail: NTIS HC/MF A03 CSCL 11C

As part of an on-going effort to develop an understanding of how changes in the chemical structure affect polymer properties, an empirical study was performed on polyimides containing only ether and/or carbonyl connecting groups in the polymer backbone. During the past two decades the structure-property relationships in linear aromatic polyimides have been extensively investigated. More recently, work has been performed to study the effect of isomeric attachment of keto-ether polyimides on properties such as glass transition temperature and solubility. However, little work has been reported on the relation of polyimide structure to mechanical properties. The purpose of this study was to determine the effect of structural changes in the backbone of keto-ether polyimides on their mechanical properties, specifically, unoriented thin film tensile properties. This study was conducted in two stages. The purpose of the initial stage was to examine the physical and mechanical properties of a representative group (four) of polyimide systems to determine the optimum solvent and cure cycle requirements. These optimum conditions were then utilized in the second stage to prepare films of keto-ether polyimides which were evaluated for mechanical and physical properties. All of the polyimides were prepared using isomers of oxydianiline (ODA) and diaminobenzophenone (DABP) in combination with 3,3',4,4'-benzophenonetetracarboxylic dianhydride (BTDA) and 4,4'-oxydiphthalic anhydride (ODPA). Author

N92-15191*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
TRIBOLOGY NEEDS FOR FUTURE SPACE AND AERONAUTICAL SYSTEMS
Robert L. Fusaro Dec. 1991 40 p
(NASA-TM-104525; E-6399; NAS 1.15:104525) Avail: NTIS HC/MF A03 CSCL 11C

Future aeronautical and space missions will push tribology technology beyond its current capability. The objective is to discuss the current state of the art of tribology as it is applied to advanced aircraft and spacecraft. Areas of discussion include materials lubrication mechanisms, factors affecting lubrication, current and future tribological problem areas, potential new lubrication techniques, and perceived technology requirements that need to be met in order to solve these tribology problems. Author

N92-15192*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ELEVATED TEMPERATURE MECHANICAL BEHAVIOR OF MONOLITHIC AND SiC WHISKER-REINFORCED SILICON NITRIDES
Jonathan A. Salem, Sung R. Choi, William A. Sanders (Analex Corp., Brook Park, OH.), and Dennis S. Fox Dec. 1991 22 p
(NASA-TM-105245; E-6572; NAS 1.15:105245) Avail: NTIS HC/MF A03 CSCL 11C

The mechanical behavior of a 30 volume percent SiC whisker reinforced silicon nitride and a similar monolithic silicon nitride were measured at several temperatures. Measurements included strength, fracture toughness, crack growth resistance, dynamic fatigue susceptibility, post oxidation strength, and creep rate. Strength controlling defects were determined with fractographic analysis. The addition of SiC whiskers to silicon nitride did not substantially improve the strength, fracture toughness, or crack growth resistance. However, the fatigue resistance, post oxidation strength, and creep resistance were diminished by the whisker addition. Author

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N92-15193# Ballistic Research Labs., Aberdeen Proving Ground, MD.
TEMPERATURE COMPENSATION TECHNIQUES AND TECHNOLOGIES: AN OVERVIEW Final Report, Apr. 1989 - Apr. 1990
David L. Kruczynski and John R. Hewitt Oct. 1991 26 p
(AD-A242565; BRL-TR-3283) Avail: NTIS HC/MF A03 CSCL 19/1

Most current propulsion concepts are designed to operate below optimum performance levels solely because of the need to compensate for temperature sensitivity. Performance at ambient temperature is restricted such that firing under temperature extremes will not exceed system safety limits for pressure. This allows a propulsion concept to perform worldwide in environments ranging from desert to arctic. If a system were available which had little or no temperature sensitivity in practical operating environments (-45 C to 63 C) propulsion concepts could be designed to operate at peak pressure levels through all temperatures. Such system optimization through temperature compensation could achieve significant performance gains. Various concepts have been proposed, suggested, or, in a few cases, experimentally demonstrated which attempt to achieve temperature compensation. This paper surveys available literature on such concepts and assesses the practicality and performance benefits of each. Concepts addressed include chemical techniques (propellant formulation and use of additives), propellant surface area control, and relatively new volume compensation techniques. GRA

N92-15194# Naval Postgraduate School, Monterey, CA.
PARTICLE-SIZING SYSTEM FOR SCANNING ELECTRON MICROSCOPE IMAGES OF SOLID-PROPELLANT COMBUSTION EXHAUST M.S. Thesis
Yeaw-Lip Lee Mar. 1991 149 p
(AD-A242700) Avail: NTIS HC/MF A07 CSCL 21/2

Accurate measurement of particle size distribution of rocket motor exhausts is essential for predicting the combustion efficiency and infrared plume signature. This thesis presents an automated method for extracting particle size distribution from scanning electron microscope (SEM) images. The SEM images were taken off a filter paper placed at the end of a collection probe inserted into the exhaust plume. The automated SEM extraction system consists of an IBM AT-based computer system fitted with a 512 x

480 pixel frame grabber. Photographic images taken off the SEM are acquired via a vidicon camera. A C language program was written to control the hardware and automate the extraction process. A threshold is first applied to the digitized image and the resulting binary image is subjected to object segmentation. Each object is then sized and the distribution from one or more images can be plotted. The main bulk of this thesis is to document the software specially written to undertake this set of tasks. Results obtained were compared with that from a Malvern MasterSizer particle sizer and were found to be favorable. Particles as small as 1/8 microns have been successfully sized. GRA

N92-15195# Naval Weapons Support Center, Crane, IN.
PERFORMANCE ORIENTED PACKAGING TESTING OF POLYSTYRENE FOAM CONTAINER FOR VARIOUS MARINE SMOKE AND ILLUMINATION SIGNALS Final Report
Billie Landstrom Sep. 1991 11 p
(AD-A242728; DOD/POPHM-DOD/NADTR91111) Avail: NTIS HC/MF A03 CSCL 13/4

Qualification tests were performed to determine whether the polystyrene foam containers, for various marine smoke and illumination signals, meet the Performance Oriented Packaging (POP) requirements specified by the United Nations Recommendations on the Transportation of Dangerous Goods. The container loaded to a gross weight of 42 pounds successfully met the requirements and retained its contents throughout the vibration, stacking, and drop tests. GRA

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology*.

N92-15196*# Intersonics, Inc., Northbrook, IL.
CONTAINERLESS HIGH TEMPERATURE PROPERTY MEASUREMENTS Final Report, 21 Sep. 1988 - 31 Oct. 1991
Paul C. Nordine, J. K. Richard Weber, Shankar Krishnan, and Collin D. Anderson 6 Dec. 1991 14 p
(Contract NAS8-37427)
(NASA-CR-184271; NAS 1.26:184271) Avail: NTIS HC/MF A03 CSCL 22A

Containerless processing in the low gravity environment of space provides the opportunity to increase the temperature at which well controlled processing of and property measurements on materials is possible. This project was directed towards advancing containerless processing and property measurement techniques for application to materials research at high temperatures in space. Containerless high temperature material property studies include measurements of the vapor pressure, melting temperature, optical properties, and spectral emissivities of solid boron. The reaction of boron with nitrogen was also studied by laser polarimetric measurement of boron nitride film growth. The optical properties and spectral emissivities were measured for solid and liquid silicon, niobium, and zirconium; liquid aluminum and titanium; and liquid Ti-Al alloys of 5 to 60 atomic pct. titanium. Alternative means for noncontact temperature measurement in the absence of material emissivity data were evaluated. Also, the application of laser induced fluorescence for component activity measurements in electromagnetic levitated liquids was studied, along with the feasibility of a hybrid aerodynamic electromagnetic levitation technique. Author

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N92-15197*# Fairchild Space Co., Germantown, MD.
ON THE NATURE OF THE FRAGMENT ENVIRONMENT CREATED BY THE RANGE DESTRUCTION OR RANDOM FAILURE OF SOLID ROCKET MOTOR CASINGS
M. Eck and M. Mukunda Jul. 1988 79 p
(Contract JPL-957524)
(NASA-CR-189442; NAS 1.26:189442; FSC-ESD-217-88-426)
Avail: NTIS HC/MF A05 CSCL 13B

Given here are predictions of fragment velocities and azimuths resulting from the Space Transportation System Solid Rocket Motor range destruct, or random failure occurring at any time during the 120 seconds of Solid Rocket Motor burn. Results obtained using the analytical methods described showed good agreement between predictions and observations for two specific events. It was shown that these methods have good potential for use in predicting the fragmentation process of a number of generically similar casing systems. It was concluded that coupled Eulerian-Lagrangian calculational methods of the type described here provide a powerful tool for predicting Solid Rocket Motor response. Author

N92-15198*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHUTTLE DATA BOOK: SRM FRAGMENT VELOCITY MODEL. PRESENTED TO THE SRB FRAGMENT MODEL REVIEW PANEL
2 Mar. 1989 70 p
(NASA-CR-189443; JPL-9950-1356; NAS 1.26:189443) Avail: NTIS HC/MF A04 CSCL 13B

This study was undertaken to determine the velocity of fragments generated by the range safety destruction (RSD) or random failure of a Space Transportation System (STS) Solid Rocket Motor (SRM). The specific requirement was to provide a fragment model for use in those Galileo and Ulysses RTG safety analyses concerned with possible fragment impact on the spacecraft radioisotope thermoelectric generators (RTGS). Good agreement was obtained between predictions and observations for fragment velocity, velocity distributions, azimuths, and rotation rates. Based on this agreement with the entire data base, the model was used to predict the probable fragment environments which would occur in the event of an STS-SRM RSD or randon failure at 10, 74, 84 and 110 seconds. The results of these predictions are the basis of the fragment environments presented in the Shuttle Data Book (NSTS-08116). The information presented here is in viewgraph form. Author

N92-15199# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
TYPES OF CONTAMINATIONS, THEIR INFLUENCE ON THE VACUUM AND OPTIMAL CLEANING TECHNOLOGY ON METAL AND GLASS PARTS FOR ULTRAHIGH VACUUM PHYSICAL EQUIPMENT
M. N. Vertes 1990 15 p
(DE91-639055; JINR-R-9-90-440) Avail: NTIS HC/MF A03

On the basis of experiences of prominent Soviet organizations and other world-wide known vacuum firms, a review of existing surface contaminations of vacuum parts is given. The surface contaminations are classified; their source and their negative effect to vacuum are discussed. The disposition of contaminations on the surface of vacuum parts is also mentioned. The requirements to a good technology of the cleaning process are listed. Optimal variants of cleaning technology of metal and glass surfaces for ultrahigh vacuum physical equipment are given. DOE

N92-15200# American Research Corp. of Virginia, Radford.
APPLICATION OF ARTIFICIAL NEURAL NETWORKS TO MACHINE VISION FLAME DETECTION Final Report, 21 May - 21 Nov. 1990
John A. Neal, Carlton E. Land, Rick R. Avent, and Russell J. Churchill Apr. 1991 56 p

(Contract F08635-90-C-0395)
(AD-A242612; ARC-TR-90-AF-A002; AFESC/ESL-TR-90-49)
Avail: NTIS HC/MF A04 CSCL 17/5

The U.S. Air Force has identified a need for rapid, accurate and reliable detection and classification of fires. To address this need, a proof-of-concept neural network-based, intelligent machine vision interface for the detection of flame signatures in the visible spectrum has been developed. The objective of the work conducted under this Phase 1 program has been to determine the feasibility of using machine vision techniques and neural network computation to detect and classify visible spectrum signatures of fire in the presence of complex background imagery. Standard fire detectors which rely on heat or smoke sensing devices tend to be slow and to react only after the fire reaches a significant level. Current electromagnetic sensing techniques have the desired speed but lack accuracy. The Phase 1 program approach to these problems used machine vision techniques to generate digitally filtered HSI (Hue, Saturation, Intensity)-formatted video data. Once filtered, these data were then presented to an artificial neural network for analysis. GRA

N92-15201# New Mexico Univ., Albuquerque. Engineering Research Inst.
ALTERNATIVE TRAINING AGENTS, PHASE 1. SURVEY OF NEAR-TERM CANDIDATE FIRE EXTINGUISHING AGENTS AND PREDICTING PROPERTIES OF HALOCARBON MIXTURES, VOLUME 1 Final Report
Jonathan S. Nimitz, Robert E. Tapscott, Stephanie R. Skaggs, and Harold D. Beeson Feb. 1991 170 p
(Contract F08635-85-C-0129)
(AD-A242814; NMERI-OC-90/17; AFESC/ESL-TR-90-39-Vol-1)
Avail: NTIS HC/MF A08 CSCL 07/1

In this report, 14 compounds are examined as potential near-term candidates for alternative firefighter training agents for streaming applications. This list consists of suitable fluorine-containing compounds (primarily fluorocarbons, hydrofluorocarbons, and hydrochlorofluorocarbons) known to have had significant toxicity testing completed, with bulk production capabilities existing in the past, present, or anticipated near future. Many of these compounds are being produced or considered as replacements for chlorofluorocarbons (CFCs) in refrigeration and foam-blowing applications. The ozone depletion potential, global warming potential, stage of toxicity testing, toxicity, availability, and relative cost of each compound are discussed. Physical and thermodynamic properties and estimated and measured flame suppression concentrations are reported. Those compounds that have low toxicity (with significant testing completed) are available in bulk and have desirable properties are discussed in detail. It is recommended that HCFC-123 be tested both in pure form and in blends as potential replacement training agents. Twelve blends are recommended for fire suppression. GRA

N92-15202# New Mexico Univ., Albuquerque. Engineering Research Inst.
HALOCARBONS AS HALON REPLACEMENTS. VOLUME 1: TECHNOLOGY REVIEW AND INITIATION Final Report, Dec. 1988 - May 1989
Jonathan S. Nimitz, Robert E. Tapscott, Stephanie R. Skaggs, and Ted A. Moore Mar. 1991 138 p
(Contract F29601-87-C-0001)
(AD-A242815; NMERI-SS-2-03-(1); AFESC/ESL-TR-90-38-Vol-1)
Avail: NTIS HC/MF A07 CSCL 13/12

The objective of this overall project is to develop one or more alternative clean halocarbon fire extinguishing streaming agents to replace Halon 1211. In this effort a technology review was conducted and an experimental plan was prepared. Screening criteria are presented with discussions and approaches to meeting the following criteria: cleanliness, toxicity, fire suppression, ozone depletion potentials (ODPs), global warming potentials (GWPs), physical properties, availability/manufacturability, cost, materials compatibility, and chemical stability. Lists of near-, medium-, and far-term candidate agents are presented. An algorithm was developed that enables prediction of atmospheric lifetimes of hydrogen-containing one- and two-carbon haloalkanes containing fluorine and/or chlorine. Relationships are examined among C-H bond strength, activation energy for hydrogen abstraction by OH, reaction rate constants, tropospheric lifetimes, and ODPs. A review of existing and emerging technologies for the destruction of halocarbons is included. GRA

N92-15203* National Aeronautics and Space Administration. Pasadena Office, CA.
MULTICOMPONENT GAS SORPTION JOULE-THOMSON REFRIGERATION Patent
Jack A. Jones, inventor (to NASA), S. Walter Petrick, inventor (to NASA), and Steven Bard, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 12 Nov. 1991 7 p Filed 28 Jun. 1990 Supersedes N90-26176 (28 - 20, p 2844)
(NASA-Case-NPO-17569-1-CU; US-Patent-5,063,747; US-Patent-Appl-SN-545236; US-Patent-Class-62-461; US-Patent-Class-624-3.2; US-Patent-Class-624-51.2; US-Patent-Class-624-467; US-Patent-Class-624-500; Int-Patent-Class-F17C-11/00) Avail: US Patent and Trademark Office CSCL 13I

The present invention relates to a cryogenic Joule-Thomson refrigeration capable of pumping multicomponent gases with a single stage sorption compressor system. Alternative methods of pumping a multicomponent gas with a single stage compressor are disclosed. In a first embodiment, the sorbent geometry is such that a void is defined near the output of the sorption compressor. When the sorbent is cooled, the sorbent primarily adsorbs the higher boiling point gas such that the lower boiling point gas passes through the sorbent to occupy the void. When the sorbent is heated, the higher boiling point gas is desorbed at high temperature and pressure and thereafter propels the lower boiling point gas out of the sorption compressor. A mixing chamber is provided to remix the constituent gases prior to expansion of the gas through a Joule-Thomson valve. Other methods of pumping a multicomponent gas are disclosed. For example, where the sorbent is porous and the low boiling point gas does not adsorb very well, the pores of the sorbent will act as a void space for the lower boiling point gas. Alternatively, a mixed sorbent may be used where a first sorbent component physically adsorbs the high boiling point gas and where the second sorbent component chemically absorbs the low boiling point gas.
Official Gazette of the U.S. Patent and Trademark Office

N92-15204# Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study.
A NEW TYPE OF LIQUID: He-3 TARGET SYSTEM USING SMALL MECHANICAL REFRIGERATORS
S. Kato, K. Kobayashi, K. Maruyama, H. Okuno, O. Konno, T. Suda, T. Maki, H. Asami, and T. Koizumi Apr. 1991 17 p
(DE91-508414; INS-870) Avail: NTIS HC/MF A03

A new type of liquid He-3 target has been developed for photoabsorption experiments at intermediate energies. Using the cooling power of liquid He-4 at reduced vapor, He-3 gas is liquefied into a cylindrical target cell of 180 ml and is maintained at 2.0 K during the experiment. Evaporated He-4 gas is evacuated by a rotary pump and returned into the He-4 bath in the cryostat, where two small mechanical refrigerators with cooling capacities of 3 W at 4.3 K and 10 W at 20 K are operated for the purpose of He-4 recondensation. A maintenance-free operation of more than 1,000 hours has become possible by adopting the He-4 circulation system. DOE

N92-15899*# Alabama Univ., Tuscaloosa. Dept. of Mechanical Engineering.
AUTOMATION OF CUTTING AND DRILLING OF COMPOSITE COMPONENTS
Charles W. Warren *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 13H

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N92-15205# Department of the Navy, Washington, DC.
BROADBAND QUADRIFILAR PHASED ARRAY HELIX Patent Application
Michael Josypenho, inventor (to Navy) 17 Oct. 1990 19 p
(AD-D015019; US-Patent-Appl-SN-559559) Avail: NTIS HC/MF A03 CSCL 09/1

A broadband quadrifilar phased array helix antenna is comprised of a pair of bifilar arrays spaced 90 deg on a coaxial fiberglass tube. A 90 deg feed phase exists between the bifilar arrays. Each bifilar array has three elements with the longest element having approximately twice the length of the shortest element and all three elements being of a length to give good broadband coverage over a specified range with specified shaped patterns being required. A 180 deg feed phase exists between adjacent elements. A number of trimming adjustments to the design of the antenna are presented for obtaining improved performance.
Author (GRA)

N92-15206# Department of the Navy, Washington, DC.
COLOR-CODED RADAR PLAN POSITION INDICATOR Patent Application
C. L. Temes, inventor (to Navy) and G. J. Linde, inventor (to Navy) 28 Jun. 1991 24 p
(AD-D015045; US-Patent-Appl-SN-722804) Avail: NTIS HC/MF A03 CSCL 17/9

A method to enhance target detectability on a radar plan position indicator is described which includes the receiving of coherent pulse-burst waveforms from a target so that at least one complete burst is included in each dwell of a scanning surveillance fan beam. A fast Fourier transform is performed on each returned coherent burst to form Doppler channels in predetermined range cells. The largest signal of the Doppler channels in each range cell is then selected and color coded. The color coded signals are applied to a plan position indicator whereby target images are viewable. Preferably, the Doppler channels are color coded over a rainbow spectrum so that a white background is produced and target images appear as tracks on a microprocessor-based raster-type plan position indicator. A continuity test and threshold test are also utilized so that target velocity and position are determined.
GRA

N92-15207# Oak Ridge National Lab., TN.
HEATING PROFILES ON ICRF ANTENNA FARADAY SHIELDS
D. J. Taylor, F. W. Baity, C. L. Hahs, B. W. Riemer, P. M. Ryan, and D. E. Williamson 1991 5 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-001679; CONF-910968-19) Avail: NTIS HC/MF A01

A conceptual design for an uncooled Faraday shield for the BPX ion cyclotron resonance heating (ICRH) antenna, which should withstand the proposed long-pulse operation, has been completed. A high-heat-flux, uncooled Faraday shield has also been designed for the fast-wave current drive (FWCD) antenna on D3-D. For both components, the improved understanding of the heating profiles made it possible to design for heat fluxes that would otherwise have been too close to mechanically establish limits. The analytical effort is described in detail, with emphasis on the design work for the BPX ICRH antenna conceptual design and for the replacement Faraday shield for the D3-D FWCD antenna. Results of analyses are shown, and configuration issues involved in component modeling are discussed.
DOE

N92-15208# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
THE PROBLEM 4/3 AND THE RINDLER-DENUR PARADOX
V. N. Streltsov 1989 9 p
(DE91-636097; JINR-E-2-89-828) Avail: NTIS HC/MF A02

The well-known problem of the definition of the electromagnetic field energy and momentum of a charge is discussed. It is shown that the recently proposed paradox about an electrostatic energy of a capacitor is related to the above problem. The physical requirement that the momentum of a charge (capacitor) at rest be equal to zero forms the basis of the considered solution of the indicated problem and paradox. This leads to an unambiguous choice of a space-like surface of integration or to the definition of the volume of a moving body.
DOE

N92-15209# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
PRESENTATION OF GREEN FUNCTION FOR RECTANGULAR WAVEGUIDE AS AN INFINITE SUM OF TENSOR SPHERICAL WAVES [PREDSTAVIENIE FUNKTSIL GRINA PRYAMOUGOLNOGO VOLNOVODA KAK BESKONESCHNOJ SUMMY TENZORNYKH SFERICHESKIKH VOLN]
V. A. Popov, K. P. Cherkasova, and N. A. Khizhnyak 1989 5 p In RUSSIAN
(DE91-624832; KFTI-89-4) Avail: NTIS HC/MF A01

Presentation of a tensor Green function for a rectangular waveguide in the form of an infinite sum of tensor spherical waves is obtained. Each summand of the sum corresponds to one of the mirror reflections of source points located in the cavity on the waveguide walls. The generalized Poisson summation formula is used for the derivation. The obtained presentation of Green function can be used for the solution of the inner boundary-value problem of electrodynamics in the case of rectangular waveguide with account of reflection from its walls.
DOE

N92-15210# European Space Agency, Paris (France).
SECOND EUROPEAN CONFERENCE ON SATELLITE COMMUNICATIONS (ECSC-2)
Brigitte Kaldeich, ed. Oct. 1991 520 p In ENGLISH and FRENCH Conference held in Liege, Belgium, 22-24 Oct. 1991
(ESA-SP-332; ISBN-92-9092-170-6; ETN-92-90461) Copyright Avail: NTIS HC/MF A22; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

Papers on network integrated, broadcasting, land mobile and VSAT (Very Small Aperture Terminals) systems and/or services are presented, together with more specific applications such as aeronautics, rural communications, local area networks interconnection, data routing and distribution, videoconferencing, store and forward messaging, etc. Data relay satellite applications together with overviews on actual systems or projects from Japan, U.S.S.R., Italy and Spain are considered. Basic technology items, mainly transmission related and payload or earth station technology aspects are addressed. The liberalization of satellite communications in Europe and the fundamental debate concerning satellite versus terrestrial communications are addressed. For individual titles, see N92-15211 through N92-15291.

N92-15211# Commission of the European Communities (Luxembourg).
LIBERALISATION OF SATELLITE COMMUNICATION IN EUROPE
Pieter S. Weltevreden *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p xv-xxxii
(For primary document see N92-15210 06-32)
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The fact that the development of satellite communications in the European Community must be brought in line with Community policies in general and the telecommunications policy and competition rules in particular is made clear. The Commission's 'Green Paper on a commmon approach in the field of satellite communications in the European Community' is discussed. It has been written at a time when the European Community is about to

achieve its aim of completing the internal market by 1992. Satellite communications can make an important contribution to this process, given the appropriate regulatory and market developments. The Satellite Green Paper is a discussion paper which, based on these Community policies and rules, proposes a number of actions to advance the field in a coherent way at European level. The objective of the Commission's Satellite Green Paper is to propose a future oriented structure for the development of satellite communications for the single market of 1992. The Green Paper intends to extend the application of the general agreed principles of Community telecommunications policy to satellite communications, taking into account the specificities of this means of communication. The proposed measures and lines of action will increase the availability of services to end users in a situation where they themselves can to a large extent determine in which way and on what basis satellite communications can satisfy their telecommunication needs. ESA

N92-15212# ANT Nachrichtentechnik, Backnang (Germany, F.R.).

INTEGRATION OF SATELLITES IN THE ATM-BASED IBC NETWORK

Ulrich Moessinger *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 3-7 (For primary document see N92-15210 06-32)

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It is proposed to make satellites an integral part of the evolving and future IBC network. For the description of the network a reference configuration is introduced. How the specific features of a satellite system can meet the requirements of an Asynchronous Transfer Mode (ATM) based network is analyzed. The impacts of ATM on the access to the satellite (medium access), the uplink and downlink capacity management, the protocols, and the payload are described and different possibilities of adaptation are discussed. In order to achieve maximum flexibility of the satellite network, it is suggested to implement onboard switching capabilities. The concept of the Distributed Memory Switch (DMS) as a possible solution for the onboard ATM switch is described, and possible alternatives for the required control of the switching functions are compared. ESA

N92-15213# Nippon Telegraph and Telephone Public Corp., Yokosuka (Japan).

SATELLITE AND TERRESTRIAL INTEGRATED SERVICES DIGITAL NETWORKS IN JAPAN

Heiichi Yamamoto and Shuzo Kato *In* ESA, Second European Conference on Satellite Communications (ECSC-1) Oct. 1991 p 9-14 (For primary document see N92-15210 06-32)

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Satellite and terrestrial Integrated Services Digital Networks (ISDN) to provide cost effective ISDN services and to enhance installation of ISDN services all over the nation are proposed. The proposed networks are based on the traffic sharing between satellite and terrestrial networks for traffic transmission among telephone offices and provide satellite subscriber lines for ISDN customers in rural areas. The former DYANET (dynamic channel assigning routing satellite aided digital networks) (1) takes the advantage of high transmission efficiency of terrestrial networks for steady traffic and the advantage of high transmission efficiency of satellite communications for light and dynamically varying traffic. By employing demand assignment and transponder hopping (for both transmission and reception) techniques, effective satellite transmission capacity is encreased to five to six times higher than that of preassignment systems. Moreover, earth station cost was significantly reduced by Large Scale Integrated Circuits (LSIC) and Monolithic Integrated Circuit (MIC) implementation and by the development of dual beam antennas. DYANET 1 has been in perfect operation employing 64 Time Division Multiple Access (TDMA) earth stations since 1988 and the latter (DYANET 2) will be put into commercial use from mid 1991. ESA

N92-15214# Ecole Nationale Superieure des Telecommunications, Paris (France).

A DYNAMIC ALLOCATION PROTOCOL FOR A SATELLITE NETWORK INTEGRATED WITH A B.ISDN

T. Zein, G. Maral, M. Tondriaux (MATRA Espace, Toulouse, France), and D. Seret *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 15-20 (For primary document see N92-15210 06-32)

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A new demand assignment multiple access approach for a satellite network integrated with an Asynchronous Transfer Mode (ATM) based Broadband Integrated Services Digital Network (B-ISDN) is proposed. The objective is to define a dynamic multiple access technique which can handle efficiently the largest number of telecommunications services with different traffic characteristics, while respecting the transfer principles of the B-ISDN. The performances of this multiple access technique are studied by simulation and a load control algorithm is derived. This algorithm prevents congestion in the satellite network by accepting and rejecting new connections according to the current load of satellite link and to the capacity required by the new connection. ESA

N92-15215# National Space Development Agency, Tokyo (Japan). Communications and Broadcasting Satellite Group.

THE OUTLINE OF THE COMMUNICATIONS AND BROADCASTING ENGINEERING TEST SATELLITE (COMETS)

Hisashi Morikawa, Toshikazu Koto, Akira Awasawa, Chiharu Ohuchi, and Yuichi Fujiwara *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 23-28 (For primary document see N92-15210 06-32)

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The National Space Development Agency of Japan (NASDA) plans to launch the Communications and Broadcasting Engineering Test Satellite (COMETS) by the H 2 rocket at the beginning of 1997. The research and development for Communications Satellite 4 (CS 4) and Experimental Data Relay and Tracking Satellite (EDRTS) were changed into the new project of COMETS in June 1990. COMETS is being developed to experimentally demonstrate new technology in the areas of inter orbit communication, the advanced satellite broadcasting on Ka band and the advanced mobile satellite communication on Ka band and millimeter wave band. The program outline of COMETS and the outline of three missions and onboard equipment are presented. ESA

N92-15216# ANT Nachrichtentechnik, Backnang (Germany, F.R.).

ROMANTIS: A COMMUNICATION SATELLITE SYSTEM FOR THE USSR

L. Friederichs and Lev. Yakovlevich Kantor (NPO Radio, Moscow, USSR) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 29-33 (For primary document see N92-15210 06-32)

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The ROMANTIS communication satellite system defined in a Soviet German cooperation aimed at a comprehensive improvement of the communications infrastructure in the whole territory of the USSR within a reasonably short time frame is considered. The services include two way voice and data communications as well as television distribution and broadcasting. The system operates at Ku band with small ground stations and uses simple Single Channel Per Carrier (SCPC) access methods. The ROMANTIS satellites, offering 50 W Effective Isotropic Radiated Power (EIRP) and 4.5 dB/K G/T in four beams, provide a high degree of flexibility coverage and connectivity of their 20 operable transponders. The occupied frequency band is reused by dual polarization and by beam isolation. The three satellite system connects about one million users. ESA

N92-15217# Ministry of Posts and Telecommunications, Moscow (USSR).
TRENDS IN SATELLITE COMMUNICATION AND BROADCASTING SYSTEM DEVELOPMENT IN THE USSR
Lev. Yakovlevich Kantor and M. M. Simonov *In* ESA, Second European Conference on Satellite Communications ECSC-2 Oct. 1991 p 35-39 (For primary document see N92-15210 06-32)
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The present state of satellite telecommunication and broadcasting in the USSR, the possibilities and prospects of further development of direct multiprogram television broadcasting, sound broadcasting, and national and international satellite communication systems are considered. The parameters of the existing and planned BSS (Broadcasting Satellite Service) and FSS (Fixed Satellite Service) satellites are discussed and the present launching systems such as Proton and Energy launchers are described. Some problems related to economical efficiency of satellite communication systems based on the concept of minimum expenses on the Earth and space segments are considered as well as the matters of an efficient utilization of the Geostationary Satellite Orbit (GSO) capacity by small earth stations. ESA

N92-15218# Alenia Spazio S.p.A., Naples (Italy).
THE ITALSAT NETWORK: A FIRST ANALYSIS OF THE EXPERIMENTAL RESULTS
G. Soccodato, A. Saitto, M. Melani, and M. Maritti *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 41-46 (For primary document see N92-15210 06-32)
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The Italsat system, after four years of development has reached is final phase. The satellite was launched at the beginning of 1991, the first traffic stations being installed at the end of the Summer of 1991. Considering that this is the first time that a regenerative payload will be used on a communications satellite, a long test campaign was carried out on the ground to integrate the different components of the network, using the satellite EM payload and three traffic stations, with one of them hosting the control center. This activity was very helpful in calibrating some parameters of the regenerative payload. The test environment and philosophy are described and the major results obtained are analyzed. All is seen as the first step to integrate a network of 64 stations in the Italian domestic telephone network. ESA

N92-15219# MATRA Espace, Toulouse (France).
HISPASAT 1: A BREAKTHROUGH IN COMMUNICATIONS SATELLITES
Michel Garreau *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 47-51 (For primary document see N92-15210 06-32)
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Principal features and background for the first generation of Hispasat space communications system approved in January 1989 by the Spanish government are presented. The development started in August 1989 and comprises two satellites and a Ground Control System (GCS). Details of the operational plan and spacecraft characteristics are given. The platform payload and main repeater equipment are described. The spacecraft operational aspects, mass budget, power budget, launcher, lifetime, development and procurement are considered. ESA

N92-15220# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
MOBILE SATELLITE SYSTEMS AT Ku AND Ka-BAND
J. Fortuny, J. Benedicto, and M. Sforza *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 55-62 (For primary document see N92-15210 06-32)
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Presently, Mobile Satellite Systems (MSS) are implemented at L band following the WARC'87 frequency allocations. However, the use of L band frequencies presents a number of problems related with the scarce spectrum resources available (29 MHz of which only 7 MHz are for the land mobile service) and the large antenna apertures required at the satellite and mobile terminal, specially for large capacity voice communication systems. Operating at higher frequency bands like 14/12 GHz or 30/20 GHz would alleviate significantly the above constraints and provide more generous link margins to cope with increased atmospheric attenuation, blockage and multipath fading. Different aspects associated with the design of a Geostationary Earth Orbit (GEO) Land Mobile Satellite System (LMSS) at Ku and Ka band for regional coverage of Europe are reviewed. The issue of frequency sharing and propagation impairments is addressed and realistic designs for the spacecraft payload and the vehicle/portable terminal antenna of an MSS operating at Ku band are proposed. ESA

N92-15221# Ecole Polytechnique Federale de Lausanne (Switzerland). Telecommunications Lab.
OPTIMUM DATA TRANSMISSION OVER LAND MOBILE SATELLITE CHANNELS
Jonathan P. Castro *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 63-69 (For primary document see N92-15210 06-32)
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Multipath fading severely restricts the accurate data transmission over land mobile satellite networks. The fading plagues the propagation medium by imposing random amplitude and phase variations on the transmission signal. However, the relative effect of an undesired random variation is reduced by the presence of a strong line of sight component. A Rician fading model is used to analyze the data transmission performance of the satellite to ground mobile channel. For this model the received multipath signal consists of the sum of a direct or line of sight component and a fading component due to reflections from objects adjacent to the transmission path. Generally, when a data packet encounters a fade, it most likely contains errors and it will have to be retransmitted. Thus, the size of the packet is crucial to determine the performance of the channel. The optimum packet size is found by applying an analytical model of the dynamics of the Rician channel. The performance criterion is based on the rate of information transfer through the network, the vehicle speed and the modulation fade margin. ESA

N92-15222# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (Germany, F.R.). Inst. for Communications Technology.
LABORATORY EVALUATION OF A CHANNEL-SENSITIVE SLOTTED ALOHA ACCESS ALGORITHM FOR LAND MOBILE SATELLITE COMMUNICATIONS
Axel Boettcher, Michael Dippold, and Axel Jahn (Fern Univ., Hagen, Germany, F.R.) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 71-76 (For primary document see N92-15210 06-32)
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Land mobile satellite communication is handicapped by fading and shadowing effects in zones with low elevation angles. Slotted Aloha is a relatively simple and attractive random access scheme for such applications, since its performance does not degrade as fast as that of other schemes. A slotted Aloha based modified channel access strategy for highly unreliable channels which requires all mobile stations in a network to estimate the link quality before starting their transmission is presented. This improved slotted Aloha with channel sensing, requiring little more complexity, is analyzed in its dynamics under channel influence with the help of a hybrid evaluation tool. The simulation concept combines software routine and hardware communication devices and includes measured channel data. Results show the improvement of the

suggested scheme in comparison to the conventional slotted Aloha. ESA

N92-15223# Technical Research Centre of Finland, Espoo. Telecommunications Lab.

STEERABLE L-BAND ANTENNA FOR LAND MOBILE VOICE COMMUNICATION TERMINAL

J. Aurinsalo, A. Hujanen, A. Jongejans (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), I. Marttila, R. Mutanen, I. Pitkaenen, and S. Tallqvist *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 77-82 Sponsored by ESA/ESTEC (For primary document see N92-15210 06-32)

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The ESA is developing an EMS (European Mobile System) land mobile voice communication system. Two steerable prototype antennas were developed for an EMS mobile voice communication terminal. The first one is a rotating antenna consisting of two OTA (One Turn Antenna) elements. The feed network generates two separate beams slightly shifted from the boresight. The tracking is based on level difference measurements from these two beams. The mechanical rotation is accomplished by the aid of a step motor. The acquisition and tracking are controlled by a microprocessor. The second antenna is a fully electronic array consisting of 12 OTA elements locating on a circle. The compact feed network gives rise to 24 separate beams in the azimuth plane. The tracking is based on the use of these multiple beams and the performance is enhanced by direction information from a digital compass. The design and performance of both these antennas are described. ESA

N92-15224# Alenia Spazio S.p.A., Naples (Italy).

A CENTRALIZED DAMA SYSTEM FOR RURAL SATELLITE TELECOMMUNICATIONS

G. Annessi, A. Pugnaloni, and M. Tripodi *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 85-89 (For primary document see N92-15210 06-32)

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The last years have seen a continuously increasing demand for telecommunication systems to serve large populations of users distributed over very wide geographical areas characterized by poor terrrestrial infrastructures and hostile environments. The telecom services required by such systems are telephony, low bit rate data circuits for telex, telemedicine and education and television broadcasting. Satellite based systems are very well suited for these applications for the wide geographical coverage and exhibit attractive flexibility and expandibility features. The thin routes telecommunications system started in the framework of the rural telecommunication systems for developing countries experiment sponsored by ESA is described. The system is based on the Single Channel Per Call (SCPC) Demand Assignment Multiple Access (DAMA) scheme managed by a single master station and allows fully meshed connections among remote terminals. ESA

N92-15225# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Directorate of Telecommunications.

WIDEBAND INTERCONNECTION OF LANs BY SATELLITE

R. A. Harris and O. Koudelka (Joanneum Research Centre, Graz, Austria) *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 91-96 (For primary document see N92-15210 06-32)

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There is an urgent need for international wideband networks to interconnect the rapidly growing number of wideband Local Area Networks (LANs). Suitable terrestrial networks will not be available for a considerable time, but satellites could meet the demand. Activities within the framework of the Cost 226 project to study and demonstrate the design and performance of suitable satellite networks, particularly for private systems are described. Attention is given to compatibility with future broadband terrestrial networks. An access and transmission concept matched to the system requirements is presented. ESA

N92-15226# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).

SPACE DATA NETWORK: CONCEPT AND RATIONALE

Klaus-Juergen Schulz *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 97-112 (For primary document see N92-15210 06-32)

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An introduction to the concept and rationale of the Space Data Network (SDN) is given. SDN is a conceptual network, which extends from ground via relay satellites to spacecraft. Due to the heterogeneity of the employed network technologies and the needs of spacecraft operation, it provides a serious technological challenge in the fields of interconnection of transmission systems, networks and service management, and uplink data control. ESA

N92-15227# Technische Hochschule, Aachen (Germany, F.R.). Dept. of Computer Science.

A MODIFIED ERROR CORRECTION PROTOCOL FOR CCITT SIGNALLING SYSTEM NO. 7 ON SATELLITE LINKS

Dieter Kreuer and Ulrich Quernheim *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 115-120 (For primary document see N92-15210 06-32)

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Comite Consultatif International des Telegraphe et Telephone (CCITT) Signalling System No. 7 (SS7) provides a level 2 error correction protocol particularly suited for links with propagation delays higher than 15 ms. Not being originally designed for satellite links, however, the so called Preventive Cyclic Retransmission (PCR) Method only performs well on satellite channels when traffic is low. A modified level 2 error control protocol, termed Fix Delay Retransmission (FDR) method is suggested which performs better at high loads, thus providing a more efficient use of the limited carrier capacity. Both the PCR and the FDR methods are investigated by means of simulation and results concerning throughput, queueing delay, and system delay, respectively. The FDR method exhibits higher capacity and shorter delay than the PCR method. ESA

N92-15228# Ecole Nationale Superieure des Telecommunications, Paris (France).

STABILIZED ALOHA-RESERVATION PROTOCOL IN A DAMA SATELLITE NETWORK

G. Maral and T. Zein *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 121-126 (For primary document see N92-15210 06-32)

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One of the possible implementations of Demand Assignment Multiple Access (DAMA) is the Aloha reservation protocol in which transmission of reservation messages is achieved on a contention basis using the S-Aloha protocol. The major disadvantage of a S-Aloha operated network is that it becomes unstable when the traffic displays high instantaneous fluctuations. This leads to an increasing amount of backlog and a vanishing throughput. The satellite network is then unable to recover normal operation without an external intervention. A modified Aloha reservation protocol, called stabilized Aloha reservation, which offers an unconditionally stable behavior of the satellite network is proposed. It applies both for star and for meshed networks and requires a small amount of additional hardware at the user's terminal. ESA

N92-15229# Spar Aerospace Ltd., Ste-Anne-de-Bellevue (Quebec).

FAST PACKET BASED ON-BOARD SWITCHING FOR ADVANCED BUSINESS SERVICES

Peter J. Garland, Shahruzi Irani, and Thomas Inukai (Communications Satellite Corp., Clarksburg, MD.) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 127-136 Sponsored by the Canadian Dept. of Communications (For primary document see N92-15210 06-32)

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Some of the features and applications of private business networks are reviewed and a fast packet technique that could be hosted on an operational Anik spacecraft in the mid-nineties is described. Current proposed on-board switching architectures are based on the circuit switched technique common to terrestrial central offices and satellite Demand Assignment Multiple Access (DAMA) systems. These architectures were first developed when the primary application for satellite communications was point to point voice trunking. Future business networks will be required to carry not only voice and circuit switched data/video traffic, but also highly bursty traffic encountered in connecting high speed local area networks. Also they will need to offer point to multipoint service. Candidate architectures for future business applications will be based on hybrid circuit/packet switches or advanced fast packet switches. These will be combined with suitable network management and congestion control techniques to ensure proper availability and delay characteristics for delay sensitive traffic. These techniques offer a more flexible approach to the handling of a diverse services mix, but require greater autonomous operation of the on board switching payload. ESA

N92-15230# Newtec Cy. N.V., Antwerp (Belgium).

VIDEOCONFERENCING SERVICES VIA SATELLITE

E. DeSonville *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 139-144 (For primary document see N92-15210 06-32)

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Videoconferencing services in general are discussed with special attention being given to satellite use. The always increasing internationalization of professional activities stimulates the demand for novel and flexible communication media. Videoconferencing is such a promising medium, for which the technology is rapidly maturing. An introductory analysis of human to human communication and its practical problems is presented, as a framework for deriving generic user requirements. The subject of videoconferencing services via satellite is approached both from the user's and from the service provider's perspective. A practical implementation of a videoconferencing network via satellite is described. ESA

N92-15231# Alenia Spazio S.p.A., Naples (Italy).

DATA/VOICE NETWORK APPLICATIONS FOR THE 20/30 GHz ITALSAT GLOBAL COVERAGE

M. Mancini, F. Martinino, and E. Salvatori *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 145-152 (For primary document see N92-15210 06-32)

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Applications of data and voice Very Small Aperture Terminals (VSAT) networks for satellite communications using the 20/30 GHz Italsat band are analyzed. To this purpose, the Italsat 20/30 GHz global coverage payload is considered. Two network architectures are proposed: a Time Division Multiplexing/Time Division Multiple Access (TDM/TDMA) star network for data communications and a Single Channel Per Call/Demand Assignment Multiple Access (SCPC/DAMA) meshed network for voice and data communications. In the network design criteria, particular emphasis is given to the adopted fading countermeasures, based on the approach of the adaptative techniques, asociated with ad hoc network control procedures. ESA

N92-15232# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.). Space Communications and Propulsion Systems Div.

LITE-SAT'S FOR SPECIFIC COMMUNICATION TASKS

H. Dodel and Ch. Riedl *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 153-158 (For primary document see N92-15210 06-32)

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Since 1957 communications satellites have shown an ascending trend towards ever more gigantic platforms. Now this trend is reversing. Intelsat 7 falls short of its predecessor. At the same time lightsats, smallsat's, and minisat's enter the scene. The scientific community, environmental research, and commercial users alike have begun to employ small spacecraft for specific communications tasks. Potential services that smaller satellites could serve adequately or even uniquely are considered and the market place and the market potential for the lightsats is depicted. An overview of the launch opportunities for these vehicles is given. The following questions are considered: how do smaller spacecraft perform in quality of manufacturing? What is the quality of manufacturing of their launchers and the reliability of the launches? Are the big platforms doomed? How reliable is commercial operation of the vehicle? What is the design maturity of spacecraft and launcher? What are the economics of the satellite production, the production of the launcher and the operational life of the satellite compared to conventional platforms? What is the intrinsic cost reduction potential of smaller satellites and economies of scale of a fleet of small satellites? How do efforts for scrapping compare for small spacecraft and, say, the 18 ton platform? ESA

N92-15233# Alcatel Espace, Toulouse (France).

A STORE-AND-FORWARD MICRO-SATELLITE SYSTEM FOR AUTONOMOUS POCKET TERMINALS

E. Lansard and A. Corain *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 159-162 (For primary document see N92-15210 06-32)

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A store and forward communication system based upon the use of microsatellites (mass less than or equal to 50 kg), that was conducted as a parametric proof of concept study is described. Main features of the proposed system are that about a few hundred users around the world can send at least four messages per day of about 1500 characters each, using autonomous pocket terminals. This concept could be peculiarly well suited for users that need discrete emission of detailed reports, such as journalistic papers. ESA

N92-15234# Ecole Nationale Superieure des Telecommunications, Paris (France). Economics Dept.

OPPORTUNITY AND VIABILITY OF A SATELLITE NETWORK FOR EASTERN COUNTRIES

Eric Jeux *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 163-166 (For primary document see N92-15210 06-32)

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The observation of Western countries' past proves that poor communications networks are not ineluctable. Nonetheless, the financial state of Eastern countries will impose on them some choices in their development plans. Very Small Aperture Terminal (VSATs) networks could be one. Several scenarios are possible, and it is the responsibility of Western firms to prove they are worthwhile and financially attractive. ESA

N92-15235# Bavarian Broadcasting Corp., Munich (Germany, F.R.).

THE SIGNIFICANCE OF SATELLITE TECHNOLOGY FOR BROADCASTING

F. Mueller-Roemer *In* ESA, Second European Conference on Satellite Communications ECSC-2 Oct. 1991 p 169-173 (For

primary document see N92-15210 06-32)
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Progress made in the development of satellite technology for broadcasting radio and television programs during the last ten years is considered. Today, alone in Europe, there are more than 50 television programs and about 40 radio programs broadcast by a large number of satellites. These programs can be received by low cost antenna systems which have a diameter of only 60 to 90 cm. A single satellite is capable of broadcasting programs over large areas of Europe. The costs are much lower than would otherwise be required to set up entire networks of terrestrial transmitters. Ultimately, satellites will form a second level of coverage for radio broadcasting. All important programs will be broadcast in future over satellite. Therefore satellites will gain ever greater significance for broadcasting corporations. ESA

N92-15236# Radio Research Inst. (USSR).
SATELLITE COMMUNICATION PAYLOADS FOR THE USSR TV BROADCASTING SYSTEMS
I. S. Tsirlin and E. I. Kumish *In* ESA, Second European Conference on Satellite Communications ECSC-2 Oct. 1991 p 175-178 (For primary document see N92-15210 06-32)
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USSR satellite television broadcasting is described. Information about the performance of the operating orbits, Ekran-M and Moskva systems is given. Satellite Communication Payload (SCP) design principles and performance are considered for these systems. Future development of the 12/18 GHz and 11/14 GHz USSR satellite television broadcasting systems is described and some information about their parameters is given. The directions of SCP development and design principles for the advanced television broadcasting systems are analyzed. ESA

N92-15237# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Inst. for Communications Technology.
EFFECTS OF HPA-NONLINEARITY ON A 4-DPSK/OFDM-SIGNAL FOR A DIGITAL SOUND BROADCASTING SIGNAL
Christoph Rapp *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 179-184 (For primary document see N92-15210 06-32)
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Orthogonal Frequency Division Multiplexing (OFDM) in conjunction with a 4 Differential Phase Shift Keying (DPSK) modulation format has been proposed for the future Digital Audio Broadcasting system (DAB), that should provide compact disk sound quality in portable, vehicular and fixed receivers. With properly chosen parameters, this system should be appropriate for both terrestrial and satellite transmission. The influence of the nonlinear distorsions introduced by the High Power Amplifier (HPA) of the transmitter is examined. In particular, the degradations in power efficiency due to intermodulation effects and backoff operating, as well as spectral degradations are investigated. It is shown for three different kinds of limiting amplifier models, that even with an output backoff in the region of 5 to 6 dB, the degradation of, for example a 512 carrier 4 DPSK/OFDM system relative to the linear case is below 1.7 dB (Pb = 0.0001), while the regenerated sidelobes of the transmitted spectrum are kept below -20 dB. ESA

N92-15238# Technische Hochschule, Aachen (Germany, F.R.). Dept. of Computer Science.
USING BROADCAST NETWORKS FOR ELECTRONIC MAIL APPLICATIONS
Kai Jakobs and Ulrich Quernheim *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 187-192 (For primary document see N92-15210 06-32)
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Benefits and problems of the use of satellite networks for electronic mail applications are discussed, with emphasis being put on group communication problems. A survey of the message handling system and the directory service is given. Related addressing issues are introduced. Two different conceivable scenarios incorporating satellite systems are examined. It is shown that satellite networks provide for some features particularly helping to reduce network load in case of intensive use of group communication services. ESA

N92-15239# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
DATA BROADCASTING USING THE MAC/PACKET STANDARDS
A. L. Buelens *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 193-197 (For primary document see N92-15210 06-32)
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The introduction of data broadcasting in MAC/packet requires the coordination of different activities for the definition of the protocols, receiver equipment development and transmit infrastructure. The results of the work carried out by ESA are presented. They cover the protocol implementation, the design of a prototype data receiver terminal and the description of the data broadcast transmit facilities required for these new services. ESA

N92-15240# British Telecom Research Labs., Ipswich (England).
SATELLITE DATA NARROWCASTING: A REALITY
W. Dobbie, N. Golfin, and P. Whitworth *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 199-203 (For primary document see N92-15210 06-32)
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The development and system of a satellite data narrowcasting system using the spare data capacity of a D-MAC television signal are discussed. A practical system is described and the results of transmission tests using low cost receiver equipment are presented. Some applications are examined to illustrate the potential of one way data delivery systems based on MAC/packet teletext. Details of a limited trial with customers are included to demonstrate that data narrowcasting is now a reality. ESA

N92-15241# Technische Hochschule, Aachen (Germany, F.R.). Lehrstuhl fuer Informatik.
PERFORMANCE EVALUATION OF THREE ACCESS PROTOCOLS FOR VSAT NETWORKS
Ulrich Quernheim, S. Jacobs, and M. Aghadavoodi Jolfaei *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 207-212 (For primary document see N92-15210 06-32)
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The performance of three access protocols for data communication on Very Small Aperture Terminal (VSAT) satellite networks is evaluated. Single Channel Per Carrier-Sequential Access (SCPC-SA) and Adaptative Assignment-Time Division Multiple Access (AA-TDMA) combine random and demand assignment access; Adaptative Priority Oriented Demand Assignment (APODA) is a new variant of CPODA. A mixed load of interactive traffic and file transfer is assumed. The protocols are modeled by queueing networks. Performance evaluation is done analytically as well as by simulations. Results show that SCPC-SA and AA-TDMA are favorable if load is low, but a pure reservation protocol is preferable for high loads and guarantees an acceptable delay of interactive messages with a higher probability than the combined protocols do. ESA

N92-15242# Surrey Univ., Guildford (England). Dept. of Electrical and Electronic Engineering.
A V-SAT MULTISERVICE ACCESS PROTOCOL BASED ON SREJ-ALOHA FCFS
F. Coakley, B. G. Evans, and T. Gervaz *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 213-217 (For primary document see N92-15210 06-32)
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Two recently proposed protocols, SREJ-Aloha and SREJ-Aloha/FCFS are compared. The simplified analytic model proposed by Raychaudhuri was found to give accurate throughput but poor delay results. A simulation of a 9.6 kb/s Very Small Aperture Terminal (VSAT) channel operated with interactive and mixed interactive/file transfer traffic showed that the SREJ-Aloha/FCFS protocol could handle about 50 percent more terminals within the same delay constraints. ESA

N92-15243# Schrack Aerospace, Vienna (Austria).
PERSONAL VSAT TERMINALS BASED ON SYNCHRONOUS CDMA SPREAD SPECTRUM TECHNIQUE
B. Eichinger, M. Sust, G. Chiassarini, and G. Gallinaro (Space Engineering, Rome, Italy) *In* ESA, Second European Conference on Satellite Communications ECSC-2 Oct. 1991 p 219-226 (For primary document see N92-15210 06-32)
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Band Limited Quasi Synchronous (BLQS) Code Division Multiple Access (CDMA) based Very Small Aperture Terminals (VSATs) are presented along with a suitable network architecture. The terminals have been termed Personal VSATs (PVSATs) due to the small physical dimensions and the great flexibility provided by the fully digital concept. BLQS-CDMA is a new satellite multiple access technique providing similar spectral efficiency to Time Division Multiple Access (TDMA) without renouncing the advantages of CDMA with respect to power flux density, off beam emission, power efficiency, security, and flexibility. ESA

N92-15244# ANT Nachrichtentechnik, Backnang (Germany, F.R.). Product Group Space Communications Systems.
NOVEL BROADBAND LINEARIZERS AND THEIR APPLICATION IN POWER AMPLIFIERS FOR SATELLITE TRANSPONDERS AND GROUND STATIONS
A.-M. Khilla *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 229-234 (For primary document see N92-15210 06-32)
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The design and test results of a space qualified wideband solid state linearizer covering the operating frequency range from 10.7 to 12.75 GHz are presented. A memory module containing the optimum tuning parameters for several frequency bands of 250 MHz bandwidth within the operating frequency band is included in the control circuit. Test results of applying the linearizer to different Traveling Wave Tube Amplifiers (TWTAs) operating over any 250 MHz bandwidth in the 10.95 to 12.75 GHz frequency range are presented. The gain compression at saturation is improved by 2.7 dB and the phase shift of the linearized TWTA is reduced to be less than 10 degrees. The first 14 GHz compact linearizer for use in satellite ground stations is presented. ESA

N92-15245# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
A COMPARATIVE STUDY OF LINEAR FILTER DISTORTION EFFECTS IN TCM AND UNCODED QPSK
S. Munoz-Garcia, J. Ventura-Traveset, and J. Benedicto *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 235-241 (For primary document see N92-15210 06-32)
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The performance of uncoded Quaternary Phase Shift Keying (QPSK) and Trellis Coded Modulation (TCM) in a channel presenting linear filter distortion is compared. A representative set of distortion patterns (sinusoidal, linear and parabolic) was chosen that covers the different types of filter distortion encountered in a satellite communication link. Computer simulations were carried out using TOPSIM 4 in order to evaluate the performance degradation for a Bit Error Rate (BER) = 0.0001. A comprehensive set of results is given in several figures, and a qualitative interpretation of results is outlined. ESA

N92-15246# Ecole Nationale Superieure d'Electronique d'Informatique et d'Hydraulique, Toulouse (France).
NUMERICAL SIMULATION AND PERFORMANCE EVALUATION OF NONLINEAR SATELLITE CHANNELS
R. Baudin and F. Castanie *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 243-248 (For primary document see N92-15210 06-32)
(Contract CNES-832-602400)
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A modified quasi-analytical method for Bit Error Rate (BER) estimation in digital nonlinear satellite channels is considered. After some considerations about the classical methods and their performances, the system model used for simulation is presented. The method is applied in two situations: the uplink noise case is first investigated, and then the case where both uplink and downlink noise sources are taken into account is analyzed. The results obtained for some realistic channel examples are presented and discussed. The comparison with Monte Carlo results and performances is particularly emphasized. ESA

N92-15247# Politecnico di Torino (Italy). Dipt. di Elettronica.
FOUR-DIMENSIONAL SIGNALING FOR SATELLITE CHANNELS
Monica Visintin, Ezio Biglieri, and Valentino Castellani *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 249-254 Sponsored by ESTEC (For primary document see N92-15210 06-32)
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Multidimensional signalling for transmission over the satellite channel, i.e., a bandlimited radio channel with nonlinearities is discussed. A set of basis signals that are orthogonal and whose bandwidth occupancy is minimal is derived. The assumption of limited bandwidth, and consequently of time unlimited signals, forces a definition of orthogonality that generalizes its classical definition. A set of basis signals that satisfy the following requirements is designed: when passed through their matched filter, the sample sequence has no intersymbol interference; when passed through the filter matched to another basis signal, the sample sequence has no interchannel interference; their bandwidth occupancy is minimum. The performance of four dimensional signals designed according to this criterion is evaluated in terms of bandwidth occupancy and error probability over nonlinear satellite channels. Comparisons with two dimensional modulation schemes (in particular, QPSK (Quaternary Phase Shift Keying) are also made. ESA

N92-15248# Ecole Nationale Superieure d'Electronique d'Informatique et d'Hydraulique, Toulouse (France).
BURST-SYMBOL DISTRIBUTION BEHAVIOUR ON A NONLINEAR CHANNEL OUTPUT
A. Benhallam and F. Castanie *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 257-262 (For primary document see N92-15210 06-32)
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Using digital computer simulation, a statistical study of channel output symbols in a satellite communication link is proposed. Three models of an uncoded transmission scheme are examined: ideal Binary Phase Shift Keying (BPSK), linear Quaternary Phase Shift Keying (QPSK) and nonlinear QPSK (with Traveling Wave Tube

(TWT) nonlinear amplifier). Interest is in modeling the error burst process in the nonlinear channel, prior to inserting the codec system. This should make it possible to improve execution speed by replacing the nonlinear channel (gaussian noise generator + TWT + filters) with a new noise generator, according to a certain statistical law. ESA

N92-15249# Carleton Univ., Ottawa (Ontario). Inst. for Electrical Engineering.

DIFFERENTIAL DETECTION OF TC-PSK WITH SUBSET DILATION

A. Yongacoglu, S. J. Spenler, and D. D. Falconer *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 263-268 (For primary document see N92-15210 06-32)

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Differential detection of Trellis Coded-Phase Shift Keying (TC-PSK) with subset dilation is considered. The implications of deviating from the PSK transmit constellations on using differential detection is explored. By introducing subset dilation, the free distance of the shortest error paths is increased. Analysis based on asymptotic coding gains and simulation results indicate that by exploiting the trellis structure, moderate bit error rate improvements are possible without increasing the receiver complexity. ESA

N92-15250# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.). Space Communications and Propulsion Systems Div.

CAN UPLINK POWER CONTROL DOUBLE SATELLITE CAPACITY?

H. Dodel and Ch. Riedl *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 269-274 (For primary document see N92-15210 06-32)

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For purposes of generic economy of scale in many modern satellite-borne communications systems single channel per carrier frequency division multiple access is resorted to. Prudent link budgeting for these transmissions forsees appropriate propagation margins to allow for meteorologically caused signal degradations prevailing for say 99.9 or 99.99 pct. of the time. This heavy rain will not appear in the whole coverage area. Therefore, not all carriers will be attenuated and some carriers will arrive with higher power levels. This effect will obviously move the transponder high power amplifier operating point thus leading to vastly increased transponder multicarrier intermodulation, and secondly it will cause small carrier suppression. Whether or not uplink power control can alleviate this problem of over proportionally degrading propagation attenuated carriers is considered. ESA

N92-15251# Politecnico di Milano (Italy). Dipt. di Elettronica.

DIGITAL CARRIER RECOVERY WITH FREQUENCY OFFSET IN SATELLITE TDMA SYSTEMS

Sandro Bellini and Claudio Molinari *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 277-281 Prepared in cooperation with CNR, Milan, Italy (For primary document see N92-15210 06-32)

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Time Division Multiple Access (TDMA) data transmission is used in various radio communication systems. In TDMA, demodulation requires the estimation of some parameters. In the systems considered the phase is acquired at the beginning of each burst, while clock and frequency are tracked from burst to burst. Two classical algorithms for phase estimation are considered: the feedforward structure proposed by Viterbi and Viterbi, and feedback structures like decision directed loops. Their acquisition and tracking performance both for coded and uncoded MPSK modulations are compared. The feedforward structure may be very sensitive to frequency offsets. Therefore, the performance of a digital frequency estimator is analyzed in detail. All the algorithms considered are easily implemented with digital hardware. ESA

N92-15252# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

A NEW SYNCHRONIZATION TECHNIQUE FOR CONVOLUTIONAL PERIODIC INTERLEAVERS

Maria-Luz deMateo *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 283-288 (For primary document see N92-15210 06-32)

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A new synchronization technique for convolutional periodic interleavers is presented. The technique depends on synch statistics (likelihood calculations) based on the undecoded data stream at the convolutional deinterleaver's output. These statistics are used to discriminate in a pairwise manner between the in sync out of sync states of the convolutional deinterleaver. The sync procedure is based on a search/lock strategy, i.e., no decision is made before a verification strategy (or repeated threshold testing) is applied. For practical purposes, the proposed solution could be implemented as a hardware device external to the convolutional periodic deinterleaver. ESA

N92-15253# British Telecommunications Research Ltd., Martlesham Heath (England).

INTERFERENCE TO SATELLITE SYSTEMS PRODUCED BY RAINSCATTER

R. G. Howell and P. T. Thompson (British Telecom International, England) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 289-293 Sponsored by British Telecom International Networks (For primary document see N92-15210 06-32)

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Data, obtained from eight small dish receivers, placed around the United Kingdom, and designed to detect the scattering by rain of signals from the British Telecom (BT) 11 GHz microwave network, is presented. Fifteen site years of measurements were analyzed to produce cumulative distributions of effective receive antenna noise temperature and, where rainscattered signals were detected, cumulative distributions of transmission loss. The results obtained are compared with those predicted by a BT/University of Essex rainscatter interference prediction model (SCIMP). ESA

N92-15254# ANT Nachrichtentechnik, Backnang (Germany, F.R.).

NOVEL ON BOARD SWITCHING PAYLOAD DESIGN WITH VARIABLE OUTPUT DATA RATES

W. Berner, F. Ortwein, and Ulrich Moessinger *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 297-302 (For primary document see N92-15210 06-32)

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Considerations to enhance the flexibility of the transmit section of regenerative communication satellite payloads are dealt with. To react quickly on traffic changes, the concept of variable data rates in the transmit section is introduced. This also enhances the efficiency of the system. The concept of variable data rates mainly influences the switch design, the modulator section and the High Power Amplifier (HPA) section. For the modulator section a vector modulator with pulseshaping at baseband is selected. The HPA section is divided in two groups with high and medium power HPAs. This solution offers the best compromise concerning feasibility, and mass and power constraints. ESA

N92-15255# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

ON-BOARD PROCESSOR ARCHITECTURE FOR THE ESA T-S-T/SS-TDMA SYSTEM

G. Garofalo *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 303-305 (For primary

document see N92-15210 06-32)
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The architecture of the On-Board Processor (OBP) which is currently being developed for the ESA T-S-T/SS-TDMA T-S-T/Satellite Switched-Time Division Multiple Access is described. The present development concerns the OBP-T switch which is a subset of the overall T-S-T system. The OB switch, with a throughput of 262.144 Mbit/s incorporates the following subsystems: on board system clock unit, control unit, time switching unit, receive interface unit, transmit interface unit. The main drive of the present development is the maximum integration degree reachable with the state of the art technology. A large use of Application Specific Integrated Circuits (ASICs) will be made in fact in order to optimize the size of the switch itself. ESA

N92-15256# ANT Nachrichtentechnik, Backnang (Germany, F.R.). Product Group Space Communications Systems.
RECONFIGURATION SWITCH MATRIX USING MMICs FOR COMMUNICATIONS SATELLITES
A.-M. Khilla, A. D. Hall, and A. Born *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 307-312 (For primary document see N92-15210 06-32)
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The feasibility study, design, manufacture, integration and measured performance of a redundant, 8 by 8 Reconfiguration Switch Matrix (RSM) at 5.5 GHz for use on-board the data Relay Satellite Systems (DRSS) are presented. The RSM includes the Radio Frequency Switch Matrix (RFSM), a Switch Matrix Controller (SMC) and a Telecommand/Telemetry Interface (TTI). Several RFSM architectures were identified, two of which could satisfy the system requirements for 60 dB isolation and noninterruptive reconfiguration. The switch elements are custom designed switched amplifiers, in GaAs Monolithic Microwave Integrated Circuits (MMIC) technology. Various SMC and TTI configurations were compared, with regard to telecommand word format, telemetry and monitoring and then designed. Finally, the RSM mechanical structure was designed for a minimum size and weight realization. This design allows for modular 8 by 8 RFSM expansion or redundant contraction. ESA

N92-15257# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
DEPLOYABLE 20/30 GHz REFLECTOR FOR FUTURE COMMUNICATIONS SATELLITES
Dietmar Scheulen *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 315-319 (For primary document see N92-15210 06-32)
(Contracts BMFT-01-YH-85070; BMFT-01-YH-85082; BMFT-01-YH-90015)
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In order to provide the technology required for future communications satellites, a new antenna system was developed. The antenna requirements and system design are considered. The deployment system and structural design of the 4.7 m deployable reflector are discussed. The panel manufacturing assembly as well as the adjustment of the reflector are dealt with. Electrical tests of the antenna system and mechanical tests of the reflector are discussed. A functional model in original size and technology was built and tested successfully. ESA

N92-15258# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.). Space Communications and Propulsion Systems.
ANTENNA SYSTEMS FOR FUTURE EUROPEAN BROADCASTING SATELLITES
M. Lieke, N. Schroeder, and Ch. Hunscher *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 321-325 (For primary document see N92-15210 06-32)
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Future European broadcasting satellite systems call for higher system capacities and lower costs per channel than today's operating direct broadcasting satellites. Highly efficient illumination of the service areas has to be performed by well contoured antenna beams in order to use the spacecraft power resources economically. Several antenna systems for these purposes are presented. For elliptical beams the elliptically contoured reflector fed by an elliptical corrugated horn is the preferred single reflector solution. Special surface shaping of main and subreflector is an attractive alternative for an elliptical beam, if a dual reflector antenna can be accommodated on the spacecraft. Multifeed antennas with single or dual mode beam forming networks have to be employed for high gain illumination of contoured, overlapping multibeam coverages. ESA

N92-15259# ERA Ltd., Leatherhead (England).
AN ADAPTIVE DIGITAL BEAMFORMING NETWORK FOR SATELLITE COMMUNICATION SYSTEMS
M. Barrett, J. Fernandez, M. A. Lagunas, and F. Coromina *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 327-332 Sponsored by ESA Prepared in cooperation with Escuela Tecnica Superior de Ingenieros de Telecommunicacion, and ESA/ESTEC (For primary document see N92-15210 06-32)
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The use of adaptive digital beamforming techniques has, until recently, been largely restricted to high performance military radar systems. Recent advances in digital technology, however, have enabled the design of single chip digital beamforming networks. This, coupled with advances in digital signal processor technology, enables complete beamforming systems to be constructed at a lower cost, thus making the application of these techniques to commercial communications systems attractive. The design and development of such an adaptative digital beamforming network are described. The system is being developed as a proof of concept laboratory based demonstrator to enable the feasibility of adaptive digital beamforming techniques for communication systems to be determined. Ultimately, digital beamforming could be used in conjunction with large array antennas for communication satellite systems. This will enable the simultaneous steering of high gain antenna beams in the direction of ground based users and the nulling of unwanted interference sources, such as radar systems, to be performed. ESA

N92-15260# ANT Nachrichtentechnik, Backnang (Germany, F.R.).
FREQUENCY ADDRESSABLE ANTENNA TECHNOLOGIES FOR SATELLITE APPLICATIONS
Hans-Peter Petry, Uwe Rosenberg, and Joerg Schneemann *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 333-338 Sponsored in part by INTELSAT (For primary document see N92-15210 06-32)
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Under consideration of inherent antenna and repeater aspects the feasibility of frequency addressable antenna principles was investigated in view of an imagined geostationary satellite application serving simultaneously the U.S. and European coverage area. Performance and equipment designs are provided for two favorable concepts, namely a passive direct radiating array and a multifeed parabolic cylindric reflector antenna. ESA

N92-15261# ANT Nachrichtentechnik, Backnang (Germany, F.R.).
A DIGITAL 16-CHANNEL COMPLEX-DOMAIN FDM-DEMULTIPLEXER FOR BEAMFORMING ENVIRONMENT
Heinz G. Goeckler and Thomas Gebauer *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 341-346 (For primary document see N92-15210 06-32)

(Contract ESTEC-9178/90)
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The specification, analysis and design of a digital 16 slot tree type Frequency Division Multiplex (FDM) demultiplexer for processing of complex valued signals are reported. The single chip Application Specific Integrated Circuits (ASIC) to be developed shall eventually be used for mobile satellite communications in a spaceborne beamforming environment. The analysis of the linear phase finite impulse response DEMUX-BFN system includes aliasing due to sample rate reduction, quantization and clipping noise distortion. As a result an overall signal to distortion ratio of better than 33 dB is obtained at the output port of a 10 element beamforming network with nulling capability. This is achieved with identical DEMUX filter cells of length 11 and an intercell signal wordlength of 8 bits. The optimized filter coefficients are represented by the canonical signed digit code most suitable for Very large Scale Integration (VLSI) implementation. ESA

N92-15262# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
ON BOARD MULTICARRIER DEMODULATOR EMPLOYING FAST ARITHMETIC FOURIER TRANSFORMATION
Uwe Hahn and Philipp Hartl (Stuttgart Univ., Germany, F.R.) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 347-353 (For primary document see N92-15210 06-32)
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The Multi Frequency Time Division Multiple Access (MFTDMA) environment necessitates frequency demultiplexing followed by subsequent demodulation of the individual uplink carriers of each station. This major component of on-board regeneration is the so called Multicarrier Demodulator (MCD). Within the Demultiplexer Section of the MCD a contiguous group of Quaternary Phase Shift Keying (QPSK) modulated carriers with different bit rates is separated into distinct frequency bands of the indivudual carriers by means of digital filtering in the frequency domain. A novel algorithm called the Fast Extended Arithmetic Fourier Transform (FEAFT) is introduced. All needed transforms from time to frequency domain and vice versa, as required for digital narrow band filtering in MCD applications are computed most efficiently in terms of computational savings by the FEAFT. Beyond that the algorithm is very well suited to parallel implementations. Computer simulations are presented to prove some new additional advantages and features of the FEAFT. ESA

N92-15263# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.). Space Communications and Propulsion Systems.
PAYLOAD TESTING APPLYING SCANNED QUIET ZONES IN A COMPENSATED COMPACT RANGE
E. Dudok, J. Habersack, H.-J. Steiner, and T. M. Smith (Space Systems/Loral, Palo Alto, CA.) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 355-360 (For primary document see N92-15210 06-32)
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A large Compensated Compact Range (CCR) was built which will be mainly used for antenna and payload tests on spacecraft level. A special test feature of the CCR where the feeds are defocused relative to the reflector optics, was extensively investigated. The defocused feeds create scanned/tilted plane waves which realize independent quiet zones that are separated in frequency and space. This spatial separation allows multiple quiet zones to be centered around the respective satellite antennas. The high quality of the scanned plane waves allows antenna patterns to be measured on the spacecraft without having to move the satellite laterally. The multiple quiet zones make all kinds of link tests possible. Both scanned plane wave quality and antenna measurement accuracy have been tested in C band and will be reported. ESA

N92-15264# Alenia Spazio S.p.A., Naples (Italy).
BASELINE DESIGN OF THE EUROPEAN DATA RELAY SYSTEM
A. Morando, R. Giubilei, G. Losquadro, and F. Martinino *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 363-370 (For primary document see N92-15210 06-32)
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The European Data Relay System (DRS) which will be an essential component of the ESA In Orbit Infrastruture (IOI) which is planned to become operational in the late 1990s is considered. The DRS will offer communication and localization service capability to the user spacecraft operating in low orbit. The baseline design of the DRS at the end of the Data Relay Preparatory Program as emerged in the period from Spring 1990 to Spring 1991 is illustrated. The system requirements and the main system design criteria are described. The satellite essential concepts and elements, with particular attention to the payload, selected as the result of an effort of complexity minimization are also described. A summary of the results achieved in the definition of the DRS ground segment is given. ESA

N92-15265# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
ESA EARTH TERMINALS IN THE EUROPEAN DATA RELAY SYSTEM
T. Beck *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 371-376 (For primary document see N92-15210 06-32)
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The projected ESA earth terminal which will be the main traffic stations for the space/ground communications via the European Data Relay System (DRS) are considered. The major station and subsystem characteristics of these terminals as derived during the detailed definition phase by European industry are described. ESA

N92-15266# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
PERFORMANCE OF DRS S-BAND IOL WITH FEC CODING IN AN RFI ENVIRONMENT: TESTBED DESIGN AND MEASUREMENT
Jean-Luc Gerner and John Quan *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 377-382 (For primary document see N92-15210 06-32)
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The versatile Data Relay Satellite (DRS) Radio Frequency Interference (RFI) testbed with its built in flexible capabilities for the simulation of the communication links between low Earth orbit satellites such as Hermes, Columbus, and ground as well as Inter Orbit Links (IOL) in an RFI environment is introduced. The DRS S-Band Inter-Orbit link (IOL) has Forward Error Correction (FEC) coding to combat RFI. Extensive results obtained from the testing of various communication link scenarios under different RFI environments are presented. The impact of various coding schemes under these circumstances are analyzed and the appropriate methods trading off the performance resulted, the power, the bandwidth needed, and the system complexity involved are recommended. ESA

N92-15267# Alcatel Espace, Toulouse (France).
S-BAND TERMINAL FOR DRS USER SPACECRAFTS
Pierre Agnus and Dominique Rousselet *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 385-391 (For primary document see N92-15210 06-32)
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S band user terminal being developed for the European Data Relay System (DRS) is described. The interest of DRS is recalled

and the need for spectrum spreading evoked before the antenna trade off is assessed. The topics which are aimed for this terminal are listed. The major items are described, essentially the SS transponder. Special features of applications like SPOT 4 and Hermes are highlighted and some future possible evolutions are eventually addressed. ESA

N92-15268# Satellites International Ltd., Newbury (England).
DATA RELAY SYSTEM SPREAD SPECTRUM RECEIVER AND MODEM
A. J. Aftelak *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 393-397 (For primary document see N92-15210 06-32)
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The ESA Data Relay System (DRS) is a spaceborne communications system which provides communications between ground stations and satellites in Low Earth Orbits (LEOs) with inter-satellite communications giving a data relay faciliity. The system requires a ground based receiver and the requirements, design, and implementation of such a receiver, which is presently under development, are described. The specification requirements for the receiver are severe, with low signal to noise ratios and high Doppler shifts. The receiver is very flexible in terms of the types of signal it can receive, which include spread spectrum signals. The receiver is implemented almost completely using digital techniques. Such an approach leads to potentially low implementation losses and allows the use of novel techniques in the receiver's subsystems. ESA

N92-15269# Alenia Spazio S.p.A., Naples (Italy).
SYSTEM ARCHITECTURES FOR DIRECT DATA DISSEMINATION VIA RELAY SATELLITES
R. Giubilei *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 399-404 (For primary document see N92-15210 06-32)
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The European Data Relay System (DRS) will be an essential component of the ESA In Orbit Infrastructure (IOI), that will give autonomy to Europe in communication, control, and monitoring of a variety of manned and unmanned spacecrafts. The present DRS baseline envisages transparent links, which relay to some ground stations all the scientific data coming from the various spacecrafts. The data stream is received on ground, where all the data are demultiplexed, depacketized, and distributed to the scientific community via conventional ground networks, or via tapes. New system architectures are investigated, in which all the data relevant to each experiment are distributed directly to its own Earth user, aiming at reducing the cost of the distributed data products and minimizing the delivery delay. ESA

N92-15270# ANT Nachrichtentechnik, Backnang (Germany, F.R.).
OPTICAL DATA COMMUNICATION FOR EARTH OBSERVATION SATELLITE SYSTEMS
J. Fischer and E. Loecherbach *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 405-414 (For primary document see N92-15210 06-32)
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The current development status of optical communication engineering in comparison to the conventional microwave systems and the different configurations of the optical data communication for Earth observation satellite systems are described. An outlook to future optical communication satellite systems is given. During the last decade Earth observation became more and more important for the extension of the knowledge about our planet and the human influence on nature. Today pictures taken by satellites are used, for example, to discover mineral resources or to predict harvest, crops, climate, and environment variations and their influence on the population. A new and up to date application for Earth observation satellites can be the verification of disarmament arrangements and the control of crises areas. To solve these tasks a system of Earth observing satellites with sensors tailored to the envisaged mission is necessary. Besides these low Earth orbiting satellites, a global Earth observation system consists of at least two data relay satellites. The communication between the satellites will be established via Inter-Satellite Links (ISL) and Inter-Orbit Links (IOL). On these links, bitrates up to 1 Gbit/s must be taken into account. Due to the increasing scarcity of suitable frequencies, higher carrier frequencies must probably be considered, and possible interference with terrestrial radio relay systems are two main problems for a realization in microwave technique. One important step to tackle these problems is the use of optical frequencies for IOL's and ISL's. ESA

N92-15271# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
THE 20/30 GHz SATELLITE GROUND STATION TECHNOLOGY
M. Ulbricht *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 417-423 (For primary document see N92-15210 06-32)
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With the successful launch of the ESA satellite Olympus and the German satellite DFS Kopernikus 1 and 2, three 20/30 GHz payloads are available in Europe. New technologies have been implemented over the last few years for ground stations which operate in the 20/30 GHz frequency range. One major advantage of this new frequency band is that the overall mechanical dimensions of the ground stations can be reduced compared to 11/14 GHz applications. Three different ground station types are described: 2.4 m ground station for television and digital transmission experiments; 1.5 m ground station for video conference; and 0.9 Very Small Aperture Terminals (VSAT) radio frequency (RF) frontend. The overall design of the ground stations shows the interactions between stringent RF requirements and their implementation, both from the electrical and mechanical point of view. This design approach results in easy to handle, transportable ground stations which also meet the high system specifications. One subsystem which introduces specific new technologies is the field of high power amplifiers. Two systems on the basis of 200 W and 5 W traveling wave tubes are presented. Special attention was given to the point of reliable power supplies. ESA

N92-15272# Technology Development Corp., Madrid (Spain).
ELECTRONICALLY STEERABLE ANTENNA FOR AIRCRAFT
J. Barbero, M. L. Hernanz, M. Hernanz, C. Martin, J. Vassallo, and B. Hedge *In* ESA, Second European Conference on Satellite Communications ECSC-2 Oct. 1991 p 425-427 (For primary document see N92-15210 06-32)
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The design of an electronically steerable medium gain antenna for aircraft able to provide voice communication via satellite is presented. The antenna consists of 5 radiating facets and the coverages achieved, including the effect of the aircraft fuselage, are based on the experimental results obtained with the actual components of the beam forming network (switches, phase shifters, power dividers) and the radiating facets including the matching network. One hundred percent of the mandatory coverage (colatitude 0 to 85 degrees) is achieved with a gain greater than 10 dBi and 12 dBi are achieved in 60 percent of it. Concerning the goal coverage (colatitude 0 to 105 degrees) a gain greater than 7 dBi is achieved in 84 percent of it. The dimensions of the radome required for this antenna are: length 1780 mm, width 255 mm, height 197 mm. ESA

N92-15273# Alenia Spazio S.p.A., Naples (Italy).
A COMPARISON BETWEEN LOW CIRCULAR AND ELLIPTICAL INCLINED ORBITS FOR SMALL SATELLITES COMMUNICATION APPLICATIONS

Giorgio Perrotta *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 431-434 (For primary document see N92-15210 06-32)
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Some results of a system study concerning the performance of large constellations of small satellites in low circular and inclined elliptical orbits for real time communications are presented. Performances are evaluated in terms of visibility and mutual connectivity for point to point regional and long distance communications. The impact of satellite crosslinks on the connectivity is also discussed. ESA

N92-15274# Alenia Spazio S.p.A., Naples (Italy).
A FULLY DIGITAL PROCESSOR FOR HIGH ACCURACY MEASUREMENTS IN THE OLYMPUS AND ITALSAT PROPAGATION EXPERIMENTS
G. Annessi, A. Pugnaloni, and M. Tripodi *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 435-440 (For primary document see N92-15210 06-32)
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In the framework of the Olympus and Italsat propagation experimemts at 12, 20, 30, 40, and 50 GHz, a fully digital signal processor was designed to perform high accuracy measurements of the amplitude and relative phases of four beacons down converted at the 25 KHz intermediate frequency. The architectural solutions adopted for the digital processor composed by four signal processing modules, a synchronization processor, a system supervision processor, and the related algorithms, are described. The main functions performed by the four signal processing modules are: coherent sampling of the beacons copolar and crosspolar components at 100 K samples/second, revelation and I and Q signal components averaging at 10 ms, 1 second, and 1 minute rates. The synchronization processor recovers the Olympus 20 GHz and Italsat 50 GHz polarization switched beacons 933 Hz modulation clock, features a false lock detection procedure, and generates the required system timings. The system supervisor collects the data packets produced by the signal processing modules and interfaces an external storage processor for measures packing and archiving. ESA

N92-15275# Telefonica, Investigacion y Desarrollo, Madrid (Spain).
INTERCONNECTION OF VSAT AND PUBLIC DATA NETWORKS
Angel Ramirez, Jesus Solana (Retevision, Spain), Ignacio Berberana, and Jose Jimenez *In* ESA, Second European Conference on Satellite Communications ECSC-2 Oct. 1991 p 441-446 (For primary document see N92-15210 06-32)
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Technology advancements have made it possible to think of Very Small Aperture Terminals (VSAT) networks as a good technical alternative for WAN's development. With the foreseen single European market and the legal frame changes expected a rapid development of these systems is likely. A draft of standards for the interconnection of VSAT systems to Packet Switched Public Data Network (PSPDN's) has been issued in such an environment. An experiment with a two way VSAT system is being performed. The experiment covers several topics including sizing availability and reliability. Those related to the interconnection to the Spanish PSPDN, IBERPAC; interconnection scenarios, connection quality requirements, addressing and facilities are considered. ESA

N92-15276# Florence Univ. (Italy). Dipt. di Ingegneria Elettronica.
PERFORMANCE EVALUATION OF AN ADVANCED FAST PACKET SWITCHING SATELLITE COMMUNICATIONS NETWORK
Enrico DelRe and Romano Fantacci *In* ESA, Second European Conference on Satellite Communications (ECSC-1) Oct. 1991 p 447-452 Sponsored by CNR (For primary document see N92-15210 06-32)
Copyright Avail: NTIS HC/MF A22; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

The performance evaluation of a fast packet switching satellite communication network is discussed. Different alternatives for the uplink access technique as well as for the architecture of the on board fast packet switching fabric are considered. The performance of the on board fast packet switching fabric was derived through computer simulation and theoretical analysis. An important result shown is that by means of a novel proposed approach it is possible to reduce the onboard switching delay without increasing the switch fabric complexity. ESA

N92-15277# Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
A 4X4 PLANAR BUTLER MATRIX FOR MULTIPORT AMPLIFIER APPLICATIONS
L. Accatino, A. Angelucci, and B. Piovano *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 453-455 (For primary document see N92-15210 06-32)
Copyright Avail: NTIS HC/MF A22; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

A planar waveguide structure implementing a 4 by 4 Butler matrix for high power multiport amplifier applications was designed and developed based on electromagnetic models of components. Two prototypes were built and tested in back to back configuration with no postmanufacturing adjustments. Measured results agree very closely with computer analyses and show an isolation in excess of 28 dB over a 16 percent bandwidth at Ku band. ESA

N92-15278# ANT Nachrichtentechnik, Backnang (Germany, F.R.). Space Communications Systems Div.
ADVANCED MODEM EQUIPMENT FOR INTELSAT IDR/IBS SERVICES
E. Auer, P. Battenschlag, P. Enders, M. Paetzold, P. Troll, and K. Grau *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 457-464 (For primary document see N92-15210 06-32)
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A general overview of an advanced modem equipment developed for Intelsat Intermediate Data Rate (IDR) and Intelsat Business Services (IBS) applications covering a range of data rates from 64 kbits/s up to 8.448 Mbit/s is presented. The modem technology which profits by an extensive use of digital signal processing techniques is presented. The Very Large Scale Integration (VLSI) integration of the underlying algorithms with Complementary Metal Oxide Semiconductors (CMOS) technology led to the design of four complex Application Specific Integrated Circuits (ASIC's) and results therefore in a very compact and economic implementation of a variable data rate Quaternary Phase Shift Keying (QPSK) modem. The principal functional building blocks are described and figured by means of numerous general block diagrams and some detailed signal flow diagrams. ESA

N92-15279# British Telecommunications Research Ltd., Martlesham Heath (England).
SLANT-PATH PROPAGATION MEASUREMENTS AT THE BRITISH TELECOM RESEARCH LABORATORIES MARTLESHAM HEATH
R. G. Howell and P. T. Thompson (British Telecom International, England) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 465-470 Sponsored by the British Telecom International Networks (For primary document see N92-15210 06-32)
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Slant path propagation measurements of attenuation and cross polar discrimination, obtained from four major satellite measurement programs are reported. The measured data covers frequencies in the range 11.3 to 30 GHz, path elevations ranging from 8.3 degrees

to 29.9 degrees and was obtained using both circularly and linearly polarized signals. The measured data is extrapolated to frequencies of 12.5, 14.3, 19.8, and 29.7 GHz and is then combined into a total database, giving in excess of 20 years of extrapolated data at each frequency. Cumulative statistics obtained from this combined data are presented. ESA

N92-15280# Racal-Decca Advanced Development Ltd., Walton-on-Thames (England).
SATELLITE POINT-TO-MULTIPOINT DATA SERVICES: OPPORTUNITIES AND ECONOMICS
I. E. Casewell, S. Connell (IFC Research, Claygate, England), and D. H. Taylor *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 471-476 (For primary document see N92-15210 06-32)
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The opportunities provided by, and the economics relating to a subset of satellite point to multipoint data services known as narrowcasting are addressed. The current status and some potential applications are described and an overview of a generalized system is provided. The issues relating to the economic viability of such services are then considered. Results generated by an economic model are included. Some criteria for ensuring the economic viability of a facsimile broadcast service as applied to electronic publishing applications are then identified. ESA

N92-15281# Kings Coll., London (England).
TRANSMISSION OF SDH SIGNALS THROUGH FUTURE SATELLITE CHANNELS USING 64-ARY QAM TRANSMISSION
A. Aghvami, O. Gemikonakli, and Shuzo Kato (Nippon Telegraph and Telephone Public Corp., Yokosuka, Japan) *In* ESA, Second European Conference on Satellite and Communications ECSC-2 Oct. 1991 p 477-480 Sponsored in part by the United Kingdom Science and Engineering Research Council (For primary document see N92-15210 06-32)
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The possibility of transmitting Synchronous Digital Hierarchy (SDH) signals through two link nonlinear satellite channels is discussed. Transmitting such high bit rate signals through standard 36 MHz transponder bandwidth requires the use of high level modulation schemes. The techniques and technologies needed to make the use of 64-ary Quadrature Amplitude Modulation (QAM) transmission feasible for future satellite communication systems are examined. It is shown that it is possible to transmit a Synchronous Transport Module-level 1 (STM-1) signal through a standard 36 MHz transponder bandwidth using 64 QAM transmission, for the 6/4 GHz band. However, for higher frequency bands, due to high fade margins needed to achieve the high availibility and performance for SDH systems, it is not practical to transmit the STM-1 signal through such standard transponder bandwidths. ESA

N92-15282# Hyperion Systems Ltd., Guildford (England).
CORPORATE STRATEGIES FOR SATELLITE COMMUNICATIONS
David G. W. Birch and S. Peter Buck *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 481-486 (For primary document see N92-15210 06-32)
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Terrestrial and satellite broadcast communications technologies, while clearly providing tremendous benefits in many market sectors, present something of a challenge to the strategic planning bodies in most organizations. This is because there is no existing analog for the services in the organizations' telecommunications networks. The marketplace is therefore a confusing place for such organizations swamped as it is with competing service providers, technologies, and services, and their telecommunications strategies cannot cope with the opportunities because they have been founded on the exploitation of point to point connections. A mechanism for creating and bounding strategies which combines the rigor of structured analysis with a comprehensive categorization of strategic directions which has been successfully used to generate new paneuropean telecommunications strategies is presented. ESA

N92-15283# Ministry of Posts and Telecommunications, Tokyo (Japan). Communications Research Lab.
EXPERIMENTAL ADVANCED MOBILE SATELLITE COMMUNICATIONS SYSTEM IN mm-WAVE AND Ka-BAND USING JAPAN'S COMETS
S. Isobe, N. Hamamoto, M. Takeuchi, S. Ohmori, and M. Yamamoto (Telecommunications Satellite Corp. of Japan, Kimitsu.) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 487-490 (For primary document see N92-15210 06-32)
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The Communications Research Laboratory (CRL) has been studying an advanced mobile satellite communications system using millimeter wave and Ka band in the Communications and Broadcasting Engineering Test Satellite (COMETS) project. The project started in 1990 and the satellite will be launched in 1997. Onboard multibeam interconnecting is one of the basic functions to realize onehop connection among mobile and hand held terminals and Very Small Aperture Terminals (VSAT's) in future mobile satellite communications systems. An intermediate frequency (IF) filter bank and regenerative transponder are suitable for this function. The transponder configuration of an advanced mobile communications mission of the COMETS for experiment is shown. High power transmitters of millimeter wave and Ka bands, a 3 by 3 IF filter bank, and Single Channel Per Carrier/Time Division Multiplexing (SCPC/TDM) regenerative modems are the purpose of studying the feasibility of advanced mobile communications systems. ESA

N92-15284# Polish Academy of Sciences, Warsaw.
THE CSMA/CD LOCAL AREA NETWORK FOR HOSPITAL SERVICES [LE RESEAU LOCAL CSMA/CD POUR LE SERVICE DES ETABLISSEMENTS HOSPITALIERS]
Tadeusz Nowicki *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 491-494 In FRENCH (For primary document see N92-15210 06-32)
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The present and future use of computers in hospitals is considered. Particular attention is given to the idea of installing magistral local area networks with multiple access and free choice type CSMA/CD (Carrier Sense Multiple Access with Collision Detection). The CSMA/CD method is discussed in detail. ESA

N92-15285# MATRA Espace, Toulouse (France).
NORMALIZATION, RELIABILITY AND VALIDATION OF INFORMATION FOR SPATIAL OPERATIONS [NORMALISATION, FIABILITE ET VALIDATION DE L'INFORMATION POUR LA CONDUITE DES OPERATIONS DES SPATIONEFS]
Philippe Pham, Philippe LeBouar, and Annick Sylvestre-Baron (Centre National d'Etudes Spatiales, Toulouse, France) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 495-504 In FRENCH (For primary document see N92-15210 06-32)
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Methods and means of validation carried out to increase the operational security and to propose a structure of operational information for spatial operations are discussed. A complete run through of the information during the conception of satellite Telecom 2 is presented and the tools used to manage and treat the continuous flow of information throughout the entire duration of the mission are considered. The normalization of the information and the respective consideration given to the contributors allows multiple validations which make the operational information more

reliable and reduces the risk of errors and free interpretations in the transfer of knowledge about the satellite. ESA

N92-15286# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
FAST PACKET SWITCHING BY SATELLITE
C. Soprano *In its* Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 507-511 (For primary document see N92-15210 06-32)
Copyright Avail: NTIS HC/MF A22; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

A simple scheme for the implementation of a fast packet switching capability on board regenerative communication satellites for support to Local Area Network (LAN) to LAN interconnections and computer to computer communications is outlined. The proposed scheme is based upon the integration of a packet switching capability within the circuit switching capability provided by the onboard processing technology being developed now for application to fixed satellite communication services. ESA

N92-15287# AEG-Telefunken, Ulm (Germany, F.R.). Opto- und Vacuumelectronics.
ACHIEVEMENTS AND NEW DEVELOPMENT TRENDS OF SATELLITE COMMUNICATION TWT's
E. Bosch, P. Heumueller, F. Bossert, H. Bradatsch, G. Kornfeld, R. Lotthammer, and H. Strauss *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 513-516 (For primary document see N92-15210 06-32)
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In spite of the 50th anniversary of the invention of the Traveling Wave Tube (TWT) principle by Kompfner and more than 30 years since the first application of a TWT for communication in the Telstar satellite 1960, todays TWT development is still progressing with remarkable speed and improvements in the field of efficiency, linearity, weight, useful life, reliability, and new frequency ranges. The respective state of the art achievements and the expected future progress based on the theoretical potentials are reviewed. The necessary computer aided design (CAD) tools and material requirements to exploit these future potentials are described. ESA

N92-15288# Bradford Univ. (England).
PROPAGATION MEASUREMENTS FOR S-BAND LAND MOBILE SATELLITE SYSTEMS USING HIGHLY ELLIPTICAL ORBITS
H. Smith, M. Sforza, B. Arbesser-Rastburg, J. P. V. Baptista (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands), and S. K. Barton *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 517-520 Sponsored in part by the UK-DTI Radiocommunication Agency (For primary document see N92-15210 06-32)
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For northern European regions, the implementation of satellites placed in highly elliptical orbits (HEO) was studied for future Land Mobile Satellite (LMS) networks, (e.g., Archimedes). For the characterization of the mobile radio channel information related to the relevant propagation phenomena is needed. A collaborative research project regarding these topics was set up in order to investigate the propagation characteristics of a HEO mobile channel in S band. The diagrams and curves presented are the results of preliminary analyses of the data collected during the experimental campaign in several environmental scenarios and for three elevation angles (40, 60, and 80 degrees). ESA

N92-15289# Sait Electronics S.A., Brussels (Belgium).
SATELLITE NETWORKS: SPECIALIZED OR INTEGRATED?
Andre Dumont *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 521-523 (For primary document see N92-15210 06-32)
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The use of space communications in Europe today is mainly restricted to PTT's and television broadcasters. Therefore, the users do not know very much about its capabilities. More recently dedicated systems have been demonstrated by the European Space Agency. The users reactions are presented, and conclusions are drawn. ESA

N92-15290# British Telecommunications Research Ltd., Martlesham Heath (England).
THE OLYMPUS PHASE-1 SS-TDMA EXPERIMENT: SYSTEM DESIGN AND RESULTS
K. R. G. Fowler and T. E. Rowe *In* ESA, Second European Conference on Satellite Comunications (ECSC-2) Oct. 1991 p 525-528 Sponsored by the British Telecommunications International Networks (For primary document see N92-15210 06-32)
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An experimental system was developed to enable Satellite Switched Time Division Multiple Access (SS-TDMA) operations to be carried out with ESA's Olympus Satellite. An SS-TDMA Acquisition and Synchronization Unit (ASU) was designed and developed to synchronize a commercial thin route TDMA system, to the Olympus onboard SS-TDMA switch. A program of cooperative experiments was then carried out to demonstrate SS-TDMA operation at 8 Mbits/s between remotely located earth stations, and to assess the performance of the ASU. The operation of the ASU is briefly described and the results of experiments presented. Three way multibeam SS-TDMA operation between the United Kingdom, Germany, and Denmark was achieved, frequency reuse performance was investigated and compressed bandwidth SS-TDMA videoconferencing, interfaced with the terrestrial network, was demonstrated. The ability of the ASU to track the onboard clock changes carried out by the satellite operator was also demonstrated. ESA

N92-15291# Italspazio, Rome (Italy).
APPLICATIONS AND ECONOMICS OF LOW EARTH ORBIT SATELLITE COMMUNICATIONS
G. Barresi, K. P. Galligan, B. Pavesi, P. Palmucci, and F. Viola (Italian Space Agency, Rome.) *In* ESA, Second European Conference on Satellite Communications (ECSC-2) Oct. 1991 p 529-533 (For primary document see N92-15210 06-32)
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The applications of small low Earth orbit satellites systems to data communications is analyzed both in terms of potential communications volume and satellite constellation configuration. A communications architecture is proposed and the configuration of the onboard processor is outlined. In conclusion, the economics of such systems are analyzed and compared with existing systems. ESA

N92-15292# European Space Agency, Paris (France). Standards Approval Board for Space Data Communications.
SPACE DATA COMMUNICATIONS
Mar. 1991 22 p
(ESA-PSS-04-0-Issue-1; ISSN-0379-4059; ETN-92-90322)
Copyright Avail: NTIS HC/MF A03

The architecture of the space data communications documentation tree, which forms the PSS-04 branch of the ESA Procedures, Specifications and Standards (PSS) series is introduced and defined. The purpose of the Space Data Communications PSS documents is to ensure the compatibility of spacecraft Telemetry, Tracking and Command subsystems with the relevant ESA infrastructure (i.e., the ESA (ESOC) tracking and data communication network and the ESA (ESTEC) satellite check out facilities). ESA

N92-15293# Los Alamos National Lab., NM.
IMPULSE RESPONSE FUNCTION FOR A TRANSIONOSPHERIC SIGNAL INTO A GAUSSIAN FILTER
R. S. Massey Oct. 1991 5 p
(Contract W-7405-eng-36)
(DE92-002042; LA-11868-MS) Avail: NTIS HC/MF A01

In analyzing data from narrow-band pulsed (EMP) receivers, it is necessary to know the response of the receivers to the resulting chirped transionospheric signal. For the case of a receiver with a Gaussian filter, it is possible to derive an analytic approximation to the response that is quite useful. The output of a Gaussian filter centered in the VHF band to an electromagnetic impulse that has propagated through a nonmagnetized ionosphere is calculated. The employed method estimates the convolved transfer function of the filter and ionosphere in the frequency domain and takes the inverse Fourier transform to obtain the time domain, impulse response function. DOE

N92-15294# Naval Postgraduate School, Monterey, CA.
PROFILE SAMPLING DEPENDENCE OF THE MLAYER PROGRAM M.S. Thesis
Ting-Hsun Chang Mar. 1991 98 p
(AD-A242450) Avail: NTIS HC/MF A05 CSCL 12/5

The dependence of the predictions of the MLAYER program on the set of heights at which the refractive index value are sampled from a fixed reference profile are analyzed. A refractivity profile with a four-meter evaporation duct is adopted as a reference. Two variable piecewise linear profiles of four and five segments, respectively, are used to approximate the reference profile for MLAYER computations. The sensitivities of the waveguide mode location, the range attenuation rate, and the height-gain function to the changes of the piece-wise linear profiles are investigated at the frequencies 3, 6, 10, and 15 GHz. The frequency dependence of the dominant mode for one profile is also studied to investigate the fact that the sensitivity to changes in sampling point location is lower at GHz than at other frequencies. A general rule-of-thumb for the change in range attenuation rate due to a slight change in refractivity is suggested. GRA

N92-15295# Naval Postgraduate School, Monterey, CA.
EFFICIENT TECHNIQUE FOR CALCULATING NEAR-FIELDS DUE TO 2-D SOURCES M.S. Thesis
Richard A. Rostant Dec. 1990 136 p
(AD-A242537) Avail: NTIS HC/MF A07 CSCL 20/14

Numerous methods exist to calculate near-fields from two-dimensional objects, however, relatively long computation times are generally required for reasonable accuracy. Computation is slowed primarily due to the calculation of near-fields using a singular kernel. The proposed work will develop an alternate, more efficient algorithm for calculating the near-fields from surface distributions. The Singularity Extraction Technique (SET) analytically extracts the contribution due to the near-singularity and implements the remaining portion numerically. Additionally, field contributions due to regions far removed from the field point are extracted out to further reduce the computational time. The implications here are a significant reduction in CPU time as well as improved accuracy. Computer programs are developed to implement and validate the SET. Testing includes comparison of the SET with analytic solutions to electromagnetic scattering for typical objects. GRA

N92-15296# Naval Postgraduate School, Monterey, CA.
SPEECH RECOGNITION AND THE TELECOMMUNICATIONS EMERGENCY DECISION SUPPORT SYSTEM M.S. Thesis
Nancy C. Browne Mar. 1991 53 p
(AD-A242540) Avail: NTIS HC/MF A04 CSCL 25/4

The purpose of this thesis is to provide a feasibility study for incorporating speech recognition into the Telecommunications Emergency Decision Support System (TEDSS) developed by the National Communications System (NCS) and contained on a Compaq 386. The three types of speech recognition systems that were used are: the DragonDictate, a software driven system; the Verbex Series 5000, a system contained in a peripheral device; and the KeyTronic Speech Recognition System, a system contained in a keyboard in addition to using speech software. A prototype was developed using the speech systems to determine whether or not TEDSS could be combined successfully with speech recognition. The results indicate that the incorporation of speech recognition into TEDSS is possible with some modifications to TEDSS software and to the Compaq 386. GRA

N92-15297# Pennsylvania Univ., Philadelphia.
OPTICAL AND ACOUSTICAL SPECTROSCOPY OF SOLIDS Final Technical Report, 1 Nov. 1981 - 31 Oct. 1987
Elias Burstein Sep. 1991 14 p
(Contract N00014-82-K-0089)
(AD-A242546) Avail: NTIS HC/MF A03 CSCL 20/1

Research areas discussed are optical properties of molecules adsorbed at metal surfaces; valence electron excitations of atoms adsorbed at metal surfaces; raman scattering excitation-profile spectra of molecules adsorbed at metal surfaces; resonant Raman scattering by molecules adsorbed on smooth noble metal surfaces; luminescence of dye molecules adsorbed at Ag surfaces; optical phenomena at silver surfaces with submicroscope bumps; nonlocal dielectric response of rough metal surfaces; second harmonic generation by molecules adsorbed at metal surfaces; two photon excitation of luminescence by noble metals; coherent three wave frequency mixing at semiconductor surfaces; and narrow beam excitation of electromagnetic modes in prism configurations. GRA

N92-15298# Purdue Univ., West Lafayette, IN. Dept. of Electrical Engineering.
INFORMATION INTEGRATION AND SYNCHRONIZATION IN DISTRIBUTED SENSOR NETWORKS
D. N. Jayasimha, S. S. Iyengar, and R. L. Kashyap 1991 36 p
(Contracts N00014-91-J-1306; N00014-85-K-0611; NSF CCR-89-09189)
(AD-A242553) Avail: NTIS HC/MF A03 CSCL 12/7

In recent years, the study of systems with multiple sensors has been an active area of research. In this paper, we focus on the computational, i.e., architectural, algorithmic, and synchronization issues related to competitive information integration in a Distributed Sensor Network (DSN). The proposed architecture of the DSN consists of a set of binary trees whose roots are fully connected. Each node of the tree has a processing element and one or more sensors associated with it. The information from each of the sensors has to be integrated in such a manner that the communication costs are low and that the real time needs are met. We present an information integration algorithm which has a low message cost (linear in the number of nodes of the network) and a low distributed computation cost. In a distributed environment there is no central clock which regulates the activities of each node. Furthermore, the clock at each node is typically not accurate. The estimates from each of the sensors which need to be integrated have to be temporally close to each other, however. We consider the problems associated with synchronizing information to be integrated in the presence of imperfect clocks. GRA

N92-15299# Naval Postgraduate School, Monterey, CA.
A COMPARISON OF HIGH LATITUDE IONOSPHERIC PROPAGATION PREDICTIONS FROM IONCAP-PC 2.5 WITH MEASURED DATA M.S. Thesis
Marcos D. Tsolekas Dec. 1990 60 p
(AD-A242591) Avail: NTIS HC/MF A04 CSCL 04/1

Prediction of ionospheric propagation in polar regions tends to be difficult because of an increased number and variety of local ionospheric disturbances. Various programs have been developed to model ionospheric propagation, and one such program, IONCAP-PC 2.5, is tested for accuracy over a transpolar communications link, using noncentric measured reference data obtained from the University of Leicester. The field strength values predicted by IONCAP-PC 2.5 are extended to take into consideration the specific antenna designs and predicted noise levels are also calculated for the environments involved. The resulting signal-to-noise ratio is compared with the observed

signal-to-noise ratio and a statistical analysis is performed on the resulting errors. It is concluded that IONCAP-PC 2.5 predicts the signal-to-noise ratio with an error of less than 10 dB for 50 pct. of the data. However, significant errors occur when predicting extreme values for this noncentric data. Author (GRA)

N92-15300# Georgia Tech Research Inst., Atlanta.
ANALYSIS OF PROBE MEASUREMENT ACCURACIES AND SCATTERING EFFECTS Final Report, Aug. - Dec. 1989
John D. Norgard, Donald W. Metzger, and Ronald M. Sega Oct. 1991 68 p
(Contract F30602-88-D-0025)
(AD-A242672; RL-TR-91-252) Avail: NTIS HC/MF A04 CSCL 20/3

The measurement accuracy of electromagnetic (EM) field probes as a function of probe orientation relative to the incident field was investigated. In addition, the mutual coupling effects between EM field probes in close proximity to each other were observed. Far field measurements were performed in an anechoic chamber and compared to predicted values. The results were used to determine the most accurate use of EM field probes for measuring fields inside metal cavities. GRA

N92-15301# Naval Postgraduate School, Monterey, CA.
NONCOHERENT DETECTION OF BFSK SIGNALS WITH LINEAR AND NONLINEAR DIVERSITY COMBINING OVER RICIAN FADING CHANNELS WITH PARTIAL BAND INTERFERENCE M.S. Thesis
Ahmet C. Karaagac Mar. 1991 145 p
(AD-A242691) Avail: NTIS HC/MF A07 CSCL 12/9

A performance analysis is performed of Binary Orthogonal Frequency Shift Keying (BFSK) Fast Frequency Hopped (FFH) receivers implemented with both square-law and envelope detectors. Bit error probabilities of the two types of receivers for linear combining, noise-normalization combining, and self-normalization combining under worst-case partial-band interference were compared with nonselective Rician fading and thermal noise. The analysis is repeated for the case of no interference to point out the effect of fading. A study of nonlinear diversity combining receivers (self-normalization and noise-normalization) is also performed for a system model that is free from thermal noise. Envelope and square-law detectors for particular types of nonlinear combining which was studied, do not differ in performance, but this is not true for linear combining detectors. The visible superiority of envelope detectors for linear combining is noted. Nonlinear combining receivers achieve a diversity and performance improvement compared to linear combining receivers. GRA

N92-15302# Louisiana State Univ., Baton Rouge. Dept. of Computer Science.
A GENERAL THEORY OF SIGNAL INTEGRATION FOR FAULT-TOLERANT DISTRIBUTED SENSOR NETWORK Annual Progress Report No. 1, 1990 - 1991
S. S. Iyengar 20 Sep. 1991 6 p
(Contract N00014-91-J-1306)
(AD-A242695) Avail: NTIS HC/MF A02 CSCL 25/5

In recent years, the increasing sophistication of surveillance systems and tracking mechanisms has generated a great deal of interest in the development of new computational structures and architectures for detecting and tracking multiple targets, using data from many sensors. The design of spatially distributed target detection and tracking systems involves the integration of solutions obtained by solving subproblems in data-association, hypothesis testing, data fusion, etc. This must include the cooperative solution of problems by a decentralized and loosely coupled collection of processors, each of which integrates information received from a cluster of spatially distributed sensors into a manageable and reliable output for further integration at a higher level. This process requires the design of efficient architectures and computational techniques to abstractly represent and integrate sensor information. GRA

N92-15303# Naval Postgraduate School, Monterey, CA.
A COMPARISON OF HIGH-LATITUDE IONOSPHERE PROPAGATION PREDICTIONS FROM AMBCOM WITH MEASURED DATA M.S. Thesis
David J. Wilson Mar. 1991 115 p
(AD-A242698) Avail: NTIS HC/MF A06 CSCL 20/14

This thesis examines the performance of SRI's Ambient Communications (AMBCOM) model for high latitude propagation prediction. It is one in a series of studies, conducted at the Naval Postgraduate School, to establish the relative merits of several computer-based propagation prediction models using a standard set of measured data. AMBCOM modeled the propagation path between a transmitter located in the polar cap region and several midlatitude receiver sites. Model predictions were matched to measured data obtained during two high-latitude communication experiments (campaigns). The absolute difference between model signal-to-noise ratio (SNR) and measured SNR was considered as error. Error statistics were accumulated to show the distribution of the error by campaign and frequency. The percentage, by frequency, of matched AMBCOM predictions in reference to total predictions for a given frequency was considered a measure of AMBCOM performance. AMBCOM exhibited small absolute values of average error, i.e., 7-11 dB, and high percentages of matched records. The average error was typically distributed between -20 and +20 dB. Unfortunately, these are only relative measures of model performance. The site antenna and environmental data used to model high latitude campaigns were estimated not measured, and some variation in AMBCOM results may be attributable to poor estimates. The measured data were not designed specifically for model validation, and further comparisons are needed with new measured data. GRA

N92-15304# University of Southern California, Marina del Rey. Information Sciences Inst.
MULTIMEDIA CONFERENCING: HAS IT COME OF AGE?
E. M. Schooler, S. Casner, and J. Postel Aug. 1991 13 p
(Contract DABT63-91-C-0001)
(AD-A242781; ISI/RS-91-286) Avail: NTIS HC/MF A03 CSCL 25/5

Multimedia conferencing continues to be an active research area with a diversity of systems being developed for a variety of situations. In particular, multimedia conferencing is central to the idea of the Collaboratory, an electronic environment for conducting science. As a vehicle for telecollabortion, multimedia conferencing promises to provide a meeting place for those needing to work cooperatively from afar. This paper reviews current research projects in telecollaboration. We first frame the discussion of multimedia conferencing with a nomeclature and taxonomy. We compare local versus remote conferencing, touching on issues in system architecture and network communications requirements. We then examine the recurring problems researchers have observed and the solutions they have chosen. Finally, we speculate that, with the advent of new technologies and with a growing sensitivity to human factors, if multimedia conferencing has not already come of age, it now has the opportunity. GRA

N92-15305*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EXPERIMENTAL MEASUREMENTS OF SPACE STATION ANTENNA PATTERNS AT 60 GHz FOR EM ANALYSIS VERIFICATION
W. Robert Young, Berkley A. Langford, Jr., and Roger K. Vaughan (Lockheed Engineering and Sciences Co., Hampton, VA.) Oct. 1991 23 p
(NASA-TM-102632; NAS 1.15:102632) Avail: NTIS HC/MF A03 CSCL 20N

Complex body scattering is a major problem facing the electromagnetic researcher today. Computer codes are one important method for predicting such scattering. With funding from Langley, Ohio State University has developed such a code. A 30:1 scale model of the Space Station was constructed to be used as a scattering target in the verification of this code. The

purpose here is to document the methods used to make these measurements and present the results which will be used by others for code verification. Author

N92-15306*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
INTERFERENCE SUSCEPTIBILITY MEASUREMENTS FOR AN MSK SATELLITE COMMUNICATION LINK
Robert J. Kerczewski and Gene Fujikawa 1992 10 p Proposed for presentation at the 14th International Communications Satellite Systems Conference, Washington, DC, 22-26 Mar. 1992; sponsored by AIAA
(NASA-TM-105395; E-6786; NAS 1.15:105395; AIAA-92-2018)
Avail: NTIS HC/MF A02 CSCL 17B

The results are presented of measurements of the degradation of an MSK satellite link due to modulated and CW (unmodulated) interference. These measurements were made using a hardware based satellite communication link simulator at NASA-Lewis. The results indicate the amount of bit error rate degradation caused by CW interference as a function of frequency and power level, and the degradation caused by adjacent channel and cochannel modulated interference as a function of interference power level. Results were obtained for both the uplink case (including satellite nonlinearity) and the downlink case (linear channel). Author

N92-15873*# Mississippi State Univ., Mississippi State. Dept. of Physics and Astronomy.
THE BATSE SLED: THE PROBLEM AND THE CORRECTION
John Patrick Lestrade *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20N

N92-15878*# Berry Coll., Mount Berry, GA. Dept. of Physics.
AN INVESTIGATION OF PRE-LAUNCH AND IN-FLIGHT STS RANGE SAFETY RADIO SIGNAL DEGRADATION AND DROPOUT
Malcolm W. McDonald *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20N

N92-15888*# Marquette Univ., Milwaukee, WI. Dept. of Electrical and Computer Engineering.
SPACE STATION INTERNAL PROPAGATION
J. E. Richie *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N92-15307*# Johns Hopkins Univ., Baltimore, MD. Dept. of Electrical and Computer Engineering.
REDUCED ELECTRICAL BANDWIDTH RECEIVERS FOR DIRECT DETECTION 4-ARY PPM OPTICAL COMMUNICATION INTERSATELLITE LINKS Interim Progress Report, 15 Apr. - 15 Oct. 1991
Frederic M. Davidson and Xiaoli Sun Nov. 1991 35 p
(Grant NAG5-1510)
(NASA-CR-189479; NAS 1.26:189479) Avail: NTIS HC/MF A03 CSCL 09A

This interim progress report consists of copies of three reports written for NASA's Flight System Development and Demonstration (FSDD) project on optical intersatellite links. The first report, 'Test results of the PlessCor avalanche photodiode (APD) preamplifier for use in the 50 Mbps quaternary pulse position modulator (QPPM) receiver,' was prepared for NASA Goddard Space Flight Center. The second, 'Performance of Q-ary PPM receiver under additive white Gaussian noise,' was prepared at the request of NASA Lewis Research Center for testing the electronic systems for the FSDD project. The third, 'Use of a Bessel lowpass filter as an approximate raised cosine filter,' was written for raised cosine filter implementation in the FSDD QPPM receiver. Author

N92-15308# Massachusetts Inst. of Tech., Lexington.
A FRONT END FILTER SUBSYSTEM FOR AN ADAPTIVE RADAR SIGNAL PROCESSOR
C. B. Robins 12 Jul. 1991 91 p
(Contract F19628-90-C-0002)
(AD-A241028; TR-912; ESD-TR-90-187) Avail: NTIS HC/MF A05 CSCL 17/9

This report documents the front end subsystem portion of an eight-channel, adaptive nulling, radar signal processor test bed. The subsystem implements in excess of 12 billion operations per second on incoming data to effect signal conditioning through time-domain filtering. The hardware has been prototyped on eight circuit boards, each about 120 square inches, which are roughly half-populated. Compact packaging schemes are discussed in one of the appendices. This effort represents a demonstration of the technology required for a variety of on-board signal processors. Wherever possible, fault-tolerant design techniques and radiation-tolerant components have been used. The front end subsystem receives eight channels of sampled data from the eight radar receiver A/D modules at the conversion rate of 4.5 MHz. The front end employs finite impulse response (FIR) filters to perform in-phase and quadrature signal separation, channel equalization, and pulse compression. The coefficients for these filters are programmable via a VMEbus compatible interface. GRA

N92-15309# Department of the Navy, Washington, DC.
GRADED BANDGAP SEMICONDUCTOR DEVICE FOR REAL-TIME IMAGING Patent Application
V. K. Mathur, inventor (to Navy) 15 Apr. 1991 9 p
(AD-D015000; US-Patent-Appl-SN-687603) Avail: NTIS HC/MF A02 CSCL 17/5

Spectral shift between different wavelength spectra by restricted narrow bandgap absorption of incident radiation at one location on a semiconductor body, under electrical bias causing release of radiation at another emission location as a result of radiative electron-hole recombination is described. The semiconductor body is a graded bandgap establishing composition of two selected compounds alloyed to a variable, position-dependent degree between the respective radiation and emission locations at which the respective narrow and wide bandgap properties of the compounds prevail. Author (GRA)

N92-15310# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDIES ON THE DEVELOPMENT OF MOSSY ZINC ELECTRODEPOSITS FROM FLOWING ALKALINE ELECTROLYTES Ph.D. Thesis
L. McVay Jul. 1991 172 p
(Contract DE-AC03-76SF-00098)
(DE92-000961; LBL-30843) Avail: NTIS HC/MF A08

The initiation and characteristics of mossy zinc electrodeposits were investigated. Batteries with zinc electrodes are candidates for electric vehicle applications; however, this electrode is prone to form non-compact deposits that contribute to capacity loss and battery failure. Moss is deposited when the current density is far from the limiting current. This morphology first appears only after the bulk deposit is approximately 1 micron thick. In this investigation, the effects of flow rate (Re = 0-4000), current density (0-50 mA/sq cm), concentration of the electroactive species (0.25

and 0.5 M), and the concentration of supporting electrolytes (3, 6, and 12 M) on the initiation of moss were examined. The rotating concentric cylinder electrode was employed for most of the experiments. A flow channel was used to study the development of morphology. After the experiment, the deposit was characterized using microscopic, x-ray diffraction, and profilometric techniques. DOE

N92-15311# Superconducting Super Collider Lab., Dallas, TX.
LEB TUNER MADE OUT OF TITANIUM ALLOY
Y. Goren and B. Campbell Sep. 1991 11 p
(Contract DE-AC35-89ER-40486)
(DE92-001931; SSCL-505) Avail: NTIS HC/MF A03

A proposed design of a closed shell tuner for the LEB cavity is presented. The tuner is made out of Ti alloy which has a high electrical resistivity as well as very good mechanical strength. Using this alloy results in a substantial reduction in the eddy current heating as well as allowing for faster frequency control. DOE

N92-15312# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THE ELECTROMAGNETIC FIELD OF SOLENOIDS WITH TIME-DEPENDENT CURRENT
G. N. Afanasev 1989 14 p In RUSSIAN; ENGLISH summary
(DE91-636108; JINR-R-4-89-96) Avail: NTIS HC/MF A03

Electromagnetic fields of the cylindrical and toroidal solenoids with time-dependent currents are found. Their properties and the paradoxes associated with the energy transfer to the surrounding space are discussed. DOE

N92-15313# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
NON-STATIONARY THEORY OF RELATIVISTIC CARCINOTRON WITH ADDITIONAL FEEDBACK [NESTATSIONARNAYA TEORIYA RELYATIVISTSKOGO KARSINOTRONA S DOPOINITELNOJ OBRATNOJSVYAZYU]
V. A. Bondarenko, A. O. Ostrovskij, and Yu. V. Tkach 1989 11 p In RUSSIAN
(DE91-624831; KFTI-89-1) Avail: NTIS HC/MF A03

Consideration is given to results of theoretical study of the influence of additional feedback due to wave reflection on the faces of corrugated waveguide on dynamics of excitation of high-frequency oscillations by a relativistic electron beam. A self-consistent system of equations describing nonlinear dynamics of beam interactions with a corrugated waveguide segment is obtained. Numerical analysis of this system of equations is conducted for different values of beam current and reflection coefficients. It is shown that the introduction of additional feedback in the beam-backward wave system leads to formation of a self-modulation mode of oscillation generation. It is established that the starting current of self-modulation in the system with additional feedback is lower as compared to completely a consistent system. The optimal mode of wave excitation from the viewpoint of achieving the maximal efficiency is determined. DOE

N92-15314# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energij.
DARK CURRENT AND PHOTOCURRENT NOISES IN THE 3 X 10(EXP -3) - 3 X 10(EXP -1) Hz FREQUENCY RANGE
L. L. Kurchaninov, V. V. Sushkov, and R. S. Shuvalov 1989 8 p In RUSSIAN; ENGLISH summary Submitted for publication
(DE91-626074; IFVE-ONF-89-98) Avail: NTIS HC/MF A02

The dark current spectral density of photomultipliers FEhU-140, FEhU-85, and FEhU-87 in a photodiode arrangement is shown to be of the 1/f character. The instantaneous fluctuations of the dark current and the photocurrent of FEhU-140, in the frequency range where flicker noise is dominating, are found to be far from Gaussian ones. They are Gaussian type in the higher frequency range, but with the dispersion differing from the Poisson flux of electrons. DOE

N92-15315# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Product Assurance and Safety Dept.
THE WIRE WRAPPING OF HIGH-RELIABILITY CONNECTIONS
Mar. 1991 53 p
(ESA-PSS-01-730-Issue-1; ISSN-0379-4059; ETN-92-90321)
Copyright Avail: NTIS HC/MF A04

The ESA requirements and quality assurance provisions for high reliability wire wrapped connections made with round single strand silver plated wire onto appropriately designed gold plated terminals are defined. The rigorous standards set by the specification ensure that the wire wrapped connections are mechanically and electrically stable when operating under high vacuum, thermal cycling and vibration conditions imposed by space flight. ESA

N92-15316# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
MODIFICATION OF THE CONTROL MODULATOR (FOR A KLYSTRON) [MODIFIKATIE MODULATOR BESTURING]
Eric Heine 1991 3 p In DUTCH; ENGLISH summary
(LINO-1991-3; ETN-92-90300) Avail: NTIS HC/MF A01

The modulators of the klystron units for pulse injection into an accelerator were modified in order to increase the peak power of the klystrons. The modulators were modified from 4 MW RF power out and 50 micro pulses to 10 MW RF power out and 5 microsec. The required modifications of the operator interface programming are explained. ESA

N92-15317# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
A POWER CONVERTER AS AN ACTIVE FILTER FOR THE REDUCTION OF HARMONIC OSCILLATIONS IN SUPPLY NETWORK Ph.D. Thesis [STROMRICHTER ALS AKTIVE FILTER ZUR VERMINDERUNG VON OBERSCHWINGUNGEN IM VERSORGUNGSNETZ]
Song-Yul Choe 1991 123 p In GERMAN
(ETN-92-90589) Avail: NTIS HC/MF A06

An active filter is considered with regard to a harmonic oscillation compensation for a supply network. Self compensated converters with load independent current are used for the production of harmonic oscillations required for the compensation. Control design for single phase and three phase converters are presented. For single phase converters, the dynamics of flicker control are improved with an additional back coupling. A phased flicker control design is developed. A modulation process is implemented for the conversion of variance in pulse pattern. The control allows not only an increase of the bandwidth of the distance, but also a high reduction of the resonance step up. ESA

N92-15318# Technische Univ., Berlin (Germany, F.R.). Fachbereich Elektrotechnik.
A CONTRIBUTION TO THE EXAMINATION OF CHARGING BEHAVIOR OF SEALED NICKEL CADMIUM AND LEAD ACID BATTERIES Ph.D. Thesis [EIN BEITRAG ZUR UNTERSUCHUNG DES LADEVERHALTENS VON VERSCHLOSSENEN NICD- UND BLEI-SAEURE-AKKUMULATOREN]
Klaus Gutekunst 1991 123 p In GERMAN
(ETN-92-90590) Avail: NTIS HC/MF A06

Possibilities of reducing the charging time of sealed nickel cadmium batteries and maximizing the charging efficiency of sealed nickel cadmium and lead acid batteries are shown. The present state of the technique is given. Economic and ecological criteria are also considered. The construction and mode of operation of selected batteries is described. The measurement of a pressure proportional tension at a sealed nickel cadmium cell is explained using a wire strain gauge. The measurement of the pressure in a sealed lead acid cell is determined using a pressure sensor. ESA

N92-15319# National Physical Lab., Teddington (England). Div. of Radiation Science and Acoustics.
A PRECISION VOLTAGE SUPPLY FOR THE NPL PRIMARY-STANDARD ELECTRON-BEAM CALORIMETER
R. P. Sanders and C. G. Thomas Oct. 1991 14 p
(NPL-RSA(EXT)-24; ISSN-0955-9655; ETN-92-90711) Copyright Avail: NTIS HC/MF A03

The design, construction and testing of a precision direct current voltage supply with exceptional electrical properties in terms of long term stability, noise and temperature stability are described. The supply, applied to the National Physical Laboratory (NPL) electron-beam calorimeter, can be used in applications where an ultra stable voltage source is required. The reference supply is capable of providing a stable voltage output to better than 2 ppm (0.0002) over the period of a typical series of irradiations, while providing current to drive the calorimeter measurement circuit. The following steps should be taken to maximize the stability of the supply: the supply should be switched on permanently, or at least one day before maximum stability is required; the supply should be operated in an environment with minimal temperature variations; the load resistance should be made as high as possible. The voltage of output 2 may be configured to lie anywhere in the range 0 to 7 by changing the resistor values in the potential divider chain. The extremely low noise and excellent stability of the reference supply, at power levels inducing negligible self heating in the thermistor, is such that the primary standard electron beam calorimeter can be operated at the lowest dose rates demanded by radiotherapy applications. ESA

N92-15320# Purdue Univ., West Lafayette, IN. Dept. of Electrical Engineering.
FUNCTIONAL CHARACTERIZATION OF FAULT TOLERANT INTEGRATION IN DISTRIBUTED SENSOR NETWORKS
Lakshman Prasad, S. S. Iyengar, R. L. Kashyap, and R. N. Madan May 1991 21 p
(Contract N00014-90-K-0611; NSF CDR-88-03017)
(AD-A242442; TR-EE-91-23) Avail: NTIS HC/MF A03 CSCL 25/5

Fault-tolerance is an important issue in network design because sensor networks must function in a dynamic, uncertain world. In this paper, we propose a functional characterization of the fault-tolerant integration of abstract interval estimates. This model provides a test bed for a general framework which we hope to develop to address the general problem of fault-tolerant integration of abstract sensor estimates. We further propose a scheme for narrowing the width of the sensor output in a specific failure model and give it a functional representation. The main distinguishing feature of our model over the original Marzullo's model is in reducing the width of the output interval estimate significantly in most cases where the number of sensors involved is large.
Author (GRA)

N92-15321# General Electric Co., Schenectady, NY.
DEVELOPMENT OF ELEMENTS OF A HIGH T(SUB c) SUPERCONDUCTING CABLE Quarterly Report, 1 Jul. - 30 Sep. 1991
Kenneth W. Lay 30 Sep. 1991 10 p
(Contract N00014-88-C-0681)
(AD-A242479) Avail: NTIS HC/MF A02 CSCL 09/1

The program is aimed at the development of long lengths of silver-clad BSCCO. The material of choice is BSCCO-2223 with 20 K the operating temperature goal. Such a tape conductor ultimately could be used in a coil for a magnet, motor or generator. The program is designed to tackle several key problems with parallel tasks. A large variety of BSCCO powders are under investigation. Silver tubes are packed with superconductor powder and deformed to form tape conductors. An alternate method of making silver-encapsulated superconducting tape is also being pursued. Variations in the powders and processing parameters are used to optimize the tape Jc. GRA

N92-15322# Maryland Univ., College Park. Dept. of Electrical Engineering.
PULSE CODED BIOLOGICALLY MOTIVATED NEURAL-TYPE MOS CIRCUITS Semiannual Progress Report No. 4, 1 May - 1 Oct. 1991
2 Nov. 1991 11 p
(Contract N00014-90-J-1114)
(AD-A242495) Avail: NTIS HC/MF A03 CSCL 23/3

This project has two aspects, one for ONR and one for AFOSR. The ONR portion is devoted to obtaining hardware implementations for the physiological representations used in the program SYNETSIM developed by the neurophysiologist Dr. D. Hartline of Bekesy Laboratories. The AFOSR portion is for evaluation capabilities of the pulse code philosophy of neural networks. On the ONR portion of the research, several chips have been fabricated for SYNETSIM pools and a neural arithmetic unit based upon the pools. Also, a number of modifications have been made to SYNETSIM to make it a much more user-friendly program. Several papers have been presented at international conferences and the DRIVER module is under continued investigation for VLSI realization. The means to implement long term potentiation are also under continued investigation. On the AFOSR portion, a means of realizing any Hopfield-type network via pulse coded circuits was obtained. GRA

N92-15323# Chemical Research and Development Center, Aberdeen Proving Ground, MD.
SURVEY OF BIODEGRADATION OF ELECTRONIC COMPONENTS AND ASSOCIATED TESTING USING DECONTAMINATION SOLUTION Final Report, Oct. 1989 - Sep. 1990
Darrel E. Menking, Irving Barditch, and Paul Grasso Aug. 1991 25 p
(DA Proj. 1C1-62622-A-553)
(AD-A242576; CRDEC-TR-305) Avail: NTIS HC/MF A03 CSCL 09/1

Biodegradation of electronic components was investigated from historical and experimental standpoints. A literature review was conducted on new materials. Twisted wire pairs were tested for degradation by decontamination solution (DS-2). Capacitance readings were used to determine degradation. Initial readings of the immersed wires dropped to zero, indicating shorting of the wire, followed by reading oscillation and return to approximately the initial reading. This phenomenon may be due to pinhole sealing. Further testing is necessary but will require the fabrication of a bridge capable of meeting ASTM/MIL STD specifications.
Author (GRA)

N92-15324# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
THREE DIMENSIONAL TRANSIENT ANALYSIS OF MICROSTRIP CIRCUITS IN MULTILAYERED ANISOTROPIC MEDIA Annual Report, 1 Oct. 1990 - 30 Sep. 1991
J. A. Kong 14 Nov. 1991 91 p
(Contract N00014-90-J-1002)
(AD-A242577) Avail: NTIS HC/MF A05 CSCL 20/6

The coupled-wave theory is generalized to analyze the diffraction of waves by chiral gratings for arbitrary angles of incidence and polarizations. Numerical results for the Stokes parameters of diffracted Florquet modes versus the thickness of chiral gratings with various chiralities are calculated. Both horizontal and vertical incidences are considered for illustration. The diffracted waves from chiral gratings are in general elliptically polarized; and in some particular instances, it is possible for chiral gratings to convert a linearly polarized incident field into two nearly circularly polarized Floquet modes propagating in different directions. A general spectral domain formulation to the problem of radiation of arbitrary distribution of sources embedded in a horizontally stratified arbitrary magnetized linear plasma is developed. The fields are obtained in terms of electric and magnetic type dyadic Green's functions. The formulation is considerably simplified by using the kDB system of coordinates in conjunction with the Fourier transform. The distributional singular behavior of the various dyadic

Green's functions in the source region is investigated and taken into account by extracting the delta function singularities. Finally, the fields in any arbitrary layer are obtained in terms of appropriately defined global upward and downward reflection and transmission matrices. GRA

N92-15325# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

THEORETICAL ANALYSIS OF MICROWAVE AND MILLIMETER WAVE INTEGRATED CIRCUITS BASED ON MAGNETIC FILMS Annual Report, 1 Oct. 1990 - 30 Sep. 1991

J. A. Kong 13 Nov. 1991 85 p

(Contract N00014-89-J-1019)

(AD-A242583) Avail: NTIS HC/MF A05 CSCL 09/1

A full modal analysis is used to study the dispersion characteristics of microstrip lines periodically loaded with crossing strips in a stratified uniaxially anisotropic medium. Dyadic Green's functions in the spectral domain for the multilayered medium in conjunction with the vector Fourier transform (VFT) are used to formulate a coupled set of vector integral equations for the current distribution on the signal line and the crossing strips. Galerkin's procedure is applied to derive the eigenvalue equation for the propagation constant. The effect of anisotropy for both open and shielded structures on the stopband properties is investigated. The input impedance of a microstrip antenna consisting of two circular microstrip disks in a stacked configuration driven by a coaxial probe is investigated. A rigorous analysis is performed using a dyadic Green's function formulation where the mixed boundary value problem is reduced to a set of coupled vector integral equations using the vector Hankel transform. Galerkin's method is employed in the spectral domain where two sets of disk current expansions are used. One set is based on the complete set of orthogonal modes of the magnetic cavity, and the other employs Chebyshev polynomials with the proper edge condition for the disk currents. An additional term is added to the disk current expansion to properly model the current in the vicinity of the probe/disk junction. GRA

N92-15326# Ballistic Research Labs., Aberdeen Proving Ground, MD.

A COMPARATIVE STUDY OF THE REACTION DYNAMICS OF A MODEL SYSTEM USING DIFFERENT CRITERIA IN PARAMETERIZING THE POTENTIAL ENERGY FUNCTION Final Report, Feb. - Mar. 1991

Betsy M. Rice, Cary F. Chabalowski, George F. Adams, Richard C. Mowrey, and Michael J. Page Oct. 1991 29 p

(DA Proj. 1L1-61102-AH-43)

(AD-A242586; BRL-TR-3282) Avail: NTIS HC/MF A03 CSCL 09/1

A comparative study of the reaction dynamics of a model system using a potential energy function that has been parameterized according to two different criteria is presented. The molecule studied is methylene nitramine CH2NNO2 and the reaction studied is the N-N bond scission reaction. A mathematical description of the potential energy surface for the system was developed and parameters for the individual terms in the model were fitted to data obtained from ab initio computations. The first model was fitted to the Cartesian second derivatives of the energy for frequencies for the molecule. Unimolecular decay curves for the N-N bond scission reaction were computed at six energies between 2.9384 and 4.1884 eV. Not only do the two models disagree in the computed reaction rates, but the rates predicted by Model 1 are first-order and time independent while those obtained with Model 2 indicate erratic and non statistical behavior. This study shows the sensitivity of dynamics calculations to quantitative differences in potential energy surfaces fitted to different aspects of electronic structure calculations. GRA

N92-15327# United Technologies Research Center, East Hartford, CT.

CATHODE SHEATH CHARGE TRANSFER EFFECTS Interim Report, 10 Jun. 1987 - 10 Mar. 1991

H. H. Michels and Robert H. Hobbs Jul. 1991 139 p

(Contract F33615-87-C-2718)

(AD-A242647; UTRC-927703; WL-TR-91-2022) Avail: NTIS HC/MF A07 CSCL 07/2

The United Technologies Research Center, under WL Contract No. F33615-87-C-2718, has carried out a theoretical research investigation of ion-molecule reactions that take place in the sheath region of low pressure discharges in silane gas mixtures. Of particular interest were the dissociative charge transfer mechanism(s) and energy dependent reaction rates of electrons, H+, H-, H3+, and several noble gas ions (He+, Ne+, Ar+) in collisions with silane (SiH4). Such reactions are an important component in the modeling of plasma-processing discharges for producing device-quality silicon films and a detailed understanding of their kinetics is required. Similar ion-molecule reactions with methane and other lower alkanes have proven to be of importance in the analysis of hydrocarbon combustion. The results of this theoretical investigation furnish fundamental data and provide a better understanding of the role of ion collision-induced molecular decomposition. The program for the research effort under this contract was formulated into three phases. Phase 1 consisted of a critical examination of available theoretical methods, including R-matrix methods, that are applicable to the prediction of the rates of dissociative charge transfer in ion-molecule collisions. These studies resulted in the development of an improved R-matrix code which incorporated analysis of reaction products. Specific attention was given to those methods most applicable to ion collisions with silane (SiH4), and to those molecules where estimates of the general applicability and accuracy of the methods could be defined. GRA

N92-15328# Electronics Research Lab., Adelaide (Australia).

THE DESIGN OF TOPWALL WAVEGUIDE DIRECTIONAL COUPLERS

Kenneth M. Harvey Jun. 1991 22 p

(AD-A242736; ERL-0559-RN; DODA-AR-006-736) Avail: NTIS HC/MF A03 CSCL 09/1

This report outlines a procedure for the design of topwall waveguide directional couplers. It is accompanied by a listing of a GWBASIC program WGCUP.BAS that renders the whole procedure quick, easy and accurate. Author (GRA)

N92-15329# Electronics Research Lab., Adelaide (Australia).

ELECTRO-OPTIC DEVICES, COMPONENTS AND SYSTEM FOR THE MICROWAVE AND MILLIMETRE-WAVE RANGES

Yat M. Choi Jun. 1991 41 p

(AD-A242737; ERL-0551-RR; DODA-AR-006-708) Avail: NTIS HC/MF A03 CSCL 09/5

Basic characteristics, performances and designs of integrated optic devices and components for use in microwave applications and various techniques for the microwave control of optical devices are reviewed. In particular, methods of improving their performances and limitations of such devices and components are discussed. The prospects for these new technologies including recommendations for further work which are relevant to microwave and millimeter wave systems are identified. Author (GRA)

N92-15330# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

STUDY OF ASYMMETRICAL ELECTRIC DISCHARGES USING PARTICLE SIMULATION

M. V. Alves Nov. 1990 135 p In PORTUGUESE; ENGLISH summary

(DE91-642773; INPE-5198) Avail: NTIS HC/MF A07

Asymmetrical electric discharges have been widely used in the microelectronic industry. The asymmetry in the electrode areas determines the magnitude of the plasma-to-electrode voltage, V sub(a), at the powered electrode, which determines the ion bombarding energy, a critical plasma processing parameter. Two many-particle simulation codes, called P D C 1 and P D S 1, were developed. These codes are electrostatic, one-dimensional (radial) and model a bounded plasma between two infinite cylinders or two concentric spheres that can be connected to a RLC external circuit. Both codes consider asymmetrical electrode areas. In order

to simulate electrical discharges, Monte-Carlo simulation of electron-neutral and ion-neutral collisions were included. These codes were used to study the relationship between the voltage area ratio across the sheaths, V sub(a) / V sub(b), and the electrode area ratio A sub(b) / A sub(a). Simulation results agree with experimental results and also with the analytical model that includes local ionization near the electrodes, observed to occur in almost all of our simulations. DOE

N92-15331* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
MAGNETOSTRICTIVE ROLLER DRIVE MOTOR Patent
John M. Vranish, inventor (to NASA) 7 Jan. 1992 10 p Filed 10 Jan. 1991 Supersedes N91-23380 (29 - 15, p 2416)
(NASA-Case-GSC-13369-1; US-Patent-5,079,460; US-Patent-Appl-SN-645972; US-Patent-Class-310-26; US-Patent-Class-310-83; US-Patent-Class-310-265; US-Patent-Class-367-156; Int-Patent-Class-H04R-15/00) Avail: US Patent and Trademark Office CSCL 09A

A magnetostrictive drive motor is disclosed which has a rotary drive shaft in the form of a drum which is encircled by a plurality of substantially equally spaced roller members in the form of two sets of cones which are in contact with the respective cam surfaces on the inside surface of an outer drive ring. The drive ring is attached to sets of opposing pairs of magnetostrictive rods. Each rod in a pair is mutually positioned end to end within respective energizing coils. When one of the coils in an opposing pair is energized, the energized rod expands while the other rod is caused to contract, causing the drive ring to rock, i.e., rotate slightly in either the clockwise or counterclockwise direction, depending upon which rod in a pair is energized. As the drive ring is activated in repetitive cycles in either direction, one set of drive cones attempts to roll up their respective cam surface but are pinned between the drive shaft drum and the drive ring. As the frictional force preventing sliding builds up, the cones become locked, setting up reaction forces including a tangential component which is imparted to the drive shaft drum to provide a source of motor torque. Simultaneously the other set of cones are disengaged from the drive shaft drum. Upon deactivation of the magnetostrictive rod coils, the force on the drive cones is released, causing the system to return to an initial rest position. By repetitively cycling the energization of the magnetostrictive rods, the drive shaft drum indexes in microradian rotational steps.
Official Gazette of the U.S. Patent and Trademark Office

N92-15332# Sandia National Labs., Albuquerque, NM.
HIGH FREQUENCY RESPONSE OF FIBER CURRENT SENSORS WITH NONCIRCULAR AND NONCENTERED COILS
R. W. Cernosek 1991 4 p Presented at the 8th Optical Fiber Sensors Conference, Monterey, CA, 29-31 Jan. 1992
(Contract DE-AC04-76DP-00789)
(DE91-018352; SAND-91-1965C; CONF-920132-1) Avail: NTIS HC/MF A01

The frequency response of the Faraday rotation in fiber current sensors is computed and measured for sensor coils of noncircular cross section and with displaced coil and conductor axes. Resonances are observed at higher frequencies with magnitudes approaching that of the low frequency response. Narrowband current sensors at frequencies above 100 MHz are reported.
DOE

N92-15865*# Alabama A & M Univ., Huntsville. Dept. of Chemistry.
FAILURE ANALYSIS OF THE LITHIUM BATTERY: A STUDY OF THE HEADER DEPOSIT ON THE CELL TOP AND DIFFUSION WITHIN THE ELECTRODE GLASS SEAL USING NUCLEAR MICROANALYSIS AND FFTIR SPECTROSCOPY
Razi A. Hassan *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 10C

N92-15892*# Alabama Univ., Huntsville. Dept. of Computer Science.
NICKEL HYDROGEN BATTERY EXPERT SYSTEM
Sajjan G. Shiva *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 10C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N92-15333# Tokyo Univ. (Japan). Inst. of Space and Astronautical Science.
HOT WIRE MEASUREMENT OF CROSS-LINKING AND UNLINKING IN UNITING TWO CIRCULAR VORTEX RINGS
Naoki Izutsu and Yuko Oshima (Ochanomizu Women's Univ., Tokyo, Japan) Mar. 1991 54 p
(ISAS-638; ISSN-0285-6808) Avail: NTIS HC/MF A04

A laminar circular vortex ring with excellent reproducibility can be generated by pushing a mass of air through a circular orifice drilled on a buffer plate placed in front of a loudspeaker, which is driven by a stepwise voltage signal. In order to obtain complete information concerning the velocity fields during the 'uniting' of two circular vortex rings, phase-locked velocity measurement was carried out by using a single inclined hot wire point by point all over the flow field, and the vorticity fields were computed from the measured velocity fields. The vortex tubes representing the vortex rings were computed as well as the behavior of the fluid material initially held within the vortex ring, and the important differences among the vorticity, vortex tubes, and fluid materials being transported by following the velocity field were explained so as not to misread the real phenomenon and the substance of the physical mechanism. The through process can be divided into the terms of formation and approaching, first cross-linking and unlinking, second cross-linking and unlinking and decay. The first cross-linking and unlinking is 'positive' and finishes successfully by the continuous and increasing driving force on the adjoined original 'near' segments being pressed against each other, while the second cross-linking and unlinking is 'negative' and depends on the initial condition due to the monotonously decreasing driving force on the adjoined original 'far' segments in the united vortex ring. As the continuous induced velocities on the approaching and adjoining segments force the segments harder against each other, the flow region in their gap is narrowed, and immediately after, the gap cannot hold the whole flux; the flow overflows outward to create another velocity gradient that is observed as the sudden appearance of two new concentrated vorticity regions between the adjacent vortex tubes. Therefore, the vorticity in the adjoined original vortex tubes is transported, although no vorticity cancellation is recognized in the present measurement because the time scale of cancellation is much longer than that of the cross-linking and unlinking. Author

N92-15334# International Centre for Theoretical Physics, Trieste (Italy).
ON THERMAL STABILITY IN INCOMPRESSIBLE SLIP FLOW
A. R. Bestman Dec. 1990 6 p
(DE91-634187; IC-90/446) Avail: NTIS HC/MF A02

The classical problem of the stability of a layer of fluid heated from below is considered. In this example the density is low and there is slip flow at the boundary walls. The eigenvalue problem is solved by making use of the orthogonality of the Bessel function of the first kind. It is observed that the Rayleigh number for the onset of instability, in the case of marginal stability, is increased by gas rarefication. DOE

N92-15335# Joint Inst. for Nuclear Research, Dubna (USSR).
PECULIARITIES OF VOID FRACTION MEASUREMENT APPLIED TO PHYSICAL INSTALLATION CHANNELS COOLED BY FORCED HELIUM FLOW
V. V. Danilov, Yu. P. Filippov, and I. S. Mamedov 1989 12 p
(DE91-634445; JINR-E-8-89-495) Avail: NTIS HC/MF A03

The methods of optimizing the transducers designed for measurements of the void fraction of two-phase flows in the channels of round and annular cross sections are presented. On the basis of the performed analysis, concrete solutions of relatively high technical characteristics are proposed. Rated and actual characteristics of signal ranges and measurement errors are given for both sensors. Influence of the mass velocity on the void fraction of adiabatic two-phase flows is theoretically analyzed. Effects of friction and of liquid-into-vapor entrainment are shown. Calculation results are compared with the obtained experimental data for helium. Special attention is given to the specific features of the processes in channels with different cross sections. DOE

N92-15336*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THE ECKHAUS AND THE BENJAMIN-FEIR INSTABILITY NEAR A WEAKLY INVERTED BIFURCATION
Helmut R. Brand and Robert J. Deissler (Los Alamos National Lab., NM.) Nov. 1991 16 p Submitted for publication
(NASA Order C-99066-G)
(NASA-TM-105334; E-6701; NAS 1.15:105334; ICOMP-91-24)
Avail: NTIS HC/MF A03 CSCL 20D

We investigate how the criteria for two prototype instabilities in one dimensional pattern forming systems, namely for the Eckhaus instability and for the Benjamin-Feir instability, change as one goes from a continuous bifurcation, to a spatially periodic or spatially and/or time periodic state, to the corresponding weakly inverted, i.e., hysteretic, cases. We also give the generalization to two dimensional patterns in systems with anisotropy as they arise from hydrodynamic instabilities in nematic liquid crystals. Author

N92-15337# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
DISCRETIZATION OF THE INCOMPRESSIBLE NAVIER-STOKES EQUATIONS IN GENERAL COORDINATES USING CONTRAVARIANT VELOCITY COMPONENTS
J. J. I. M. vanKan, C. W. Oosterlee, A. Segal, and P. Wesseling 1991 117 p
(Rept-91-09; ISSN-0922-5641; ETN-92-90389) Copyright Avail: NTIS HC/MF A06

Navier-Stokes equations coupled with an equation of convection - diffusion type in general coordinates are presented. Basic results from tensor analysis in relation to coordinate transformations are given. The discretization of the divergence theorem is addressed. The space discretization of the incompressible Navier-Stokes equations is derived using a finite volume method. The effect of the boundary conditions on the molecules is given. The time discretization in relation to the continuity equations is addressed. ESA

N92-15338# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
THE TREATMENT OF SLIP BOUNDARY CONDITIONS FOR THE INCOMPRESSIBLE NAVIER-STOKES EQUATIONS IN GENERAL CO-ORDINATES
Guus Segal 1991 13 p
(Rept-91-22; ISSN-0922-5641; ETN-92-90402) Copyright Avail: NTIS HC/MF A03

A model for the numerical discretization of the incompressible Navier-Stokes equations in general curvilinear coordinates, which treats Dirichlet and natural boundary conditions and the seminatural outflow condition, is extended with turbulence equations. The study is devoted to the discretization of the Navier-Stokes equations with skip boundary conditions. ESA

N92-15339# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
SOLUTION OF THE DISCRETIZED INCOMPRESSIBLE NAVIER-STOKES EQUATIONS WITH THE GMRES METHOD
C. Vuik 1991 25 p
(Rept-91-24; ISSN-0922-5641; ETN-92-90403) Copyright Avail: NTIS HC/MF A03

Experiences using iterative solution methods of GMRES (Generalized Minimal Residual) type to solve the discretized Navier-Stokes equations are described. The pressure equation is solved with full GMRES combined with a suitable preconditioner. The diagonally scaled momentum equations are solved by GMRES(m), a restarted version of GMRES. ESA

N92-15340# Cranfield Inst. of Tech., Bedford (England). Dept. of Aerodynamics and Fluid Mechanics.
A LINEARISED RIEMANN SOLVER FOR THE TIME-DEPENDENT EULER EQUATIONS OF GAS DYNAMICS
E. F. Toro Jul. 1991 24 p Previously announced in IAA as A91-55028 Submitted for publication
(Cranfield-Aero-9107; ISBN-1-871564-30-1; ETN-92-90703)
Avail: NTIS HC/MF A03; Coll. of Aeronautics, Cranfield Inst. of Technology, Cranfield, Bedford MK43 0AL, England, HC 8 sterling pounds

An approximate, linearized Riemann solver for the time dependent Euler equations is presented. The Riemann solver is then used, locally, in conjunction with the weight average flux numerical method to solve the time dependent Euler equations in one and two space dimensions with general initial data. For flows with shock waves of moderate strength, the computed results are very accurate. For severe flow regimes, the use of the present linearized Riemann solver, in combination with the exact Riemann solver in an adaptive fashion, is required. One and two dimensional test problems show that the linearized Riemann solver is used in over 99 percent of the flow field, producing net computing savings by a factor of about 2. A reliable and simple switching criterion is also presented. Results show that the adaptive approach provides the resolution and robustness of the exact Riemann solver at the computing cost of the simple linearized Riemann solver. The relevance of the present methods concerns the numerical solution of multidimensional problems accurately and economically. ESA

N92-15341# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
LOW FREQUENCY APPROXIMATION TO THE INCOMPRESSIBLE NAVIER-STOKES EQUATIONS
Peter Wilde Oct. 1991 15 p Sponsored in part by Defence Material Administration
(Contract STU-88-00397P)
(FFA-TN-1991-32; ETN-92-90721) Avail: NTIS HC/MF A03

It is shown that a solution to the displacement boundary value problem for the incompressible Navier-Stokes equations can be obtained by solving a sequence of displacement problems for the Stokes equations. The solution of these Stokes problems by using both boundary integral equation methods and the null field approach, is given. In the demonstration, the statement of the problem, the low frequency approximation, and the boundary integral equation approach are explained. ESA

N92-15342# International Centre for Theoretical Physics, Trieste (Italy).
A SIMILAR SOLUTION FOR AN UNSTEADY FREE CONVECTION FLOW PAST AN IMPULSIVELY STARTED VERTICAL PLATE WITH MASS TRANSFER AND SUCTION OR INJECTION
M. A. Sattar Dec. 1990 26 p
(DE91-642287; IC-90/444) Avail: NTIS HC/MF A03

A similar solution for the flow past a vertical plate started impulsively in its own plane in a viscous incompressible fluid is presented on taking into account the effects of variable suction and/or injection and mass transfer. To solve the momentum, energy and concentration equations, a time dependent length scale is introduced, which leads to the driving parameters gamma (=G(sub

r)/R(sub sigma)(exp 2)) and gamma asterisk (=G(sub r) asterisk/R(sub sigma) (exp 2)), where G(sub r) and G(sub r) asterisk are respectively the Grashof and modified Grashof numbers while R(sub sigma) is the Reynolds number. The resulting locally similar momentum equation is then solved by the method of superposition. The effects of the parameters and that of suction/injection on the flow and on the wall shear-stress of the plate are shown graphically for different values of Schmidt number and transpiration parameter. DOE

N92-15343# International Centre for Theoretical Physics, Trieste (Italy).
THE FLOW OF A COMBUSTIBLE GAS IN A HORIZONTAL PIPE
A. R. Bestman Dec. 1990 12 p
(DE91-642288; IC-90/469) Avail: NTIS HC/MF A03

The flow of high temperature combustible gas in a horizontal pipe is studied as a model for a biomass moving bed gasifier. The general problem is a fully developed flow in a pipe in the presence of free convection heat transfer. When the flow Reynolds number is low, asymptotic solutions are developed. Several limiting solutions are developed for the basic nonlinear approximation. The higher approximations are linear and are tackled analytically and by a finite difference scheme employing central differences. The results are discussed quantitatively. DOE

N92-15344# Instituto de Fisica Teorica, Sao Paulo (Brazil).
SURFACE PERTURBATIONS OF A SHALLOW VISCOUS FLUID HEATED FROM BELOW AND THE (2+1)-DIMENSIONAL BURGERS EQUATION
R. A. Kraenkel, J. G. Pereira, and M. A. Manna 1991 14 p
(DE91-642289; IFT-P-007/91) Avail: NTIS HC/MF A03

The (2+1)-dimensional Burgers equation is obtained as the equation of motion governing the surface perturbations of a shallow viscous fluid heated from below, provided the Rayleigh number of the system satisfies the condition R not = 30. A solution to this equation is explicitly exhibited and it is argued that it describes the nonlinear evolution of a nearly one-dimensional kink. DOE

N92-15345# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
ANALYSIS, SCIENTIFIC COMPUTING, AND FUNDAMENTAL STUDIES IN FLUID MECHANICS
H. B. Keller and P. G. Saffman 1991 7 p
(Contract DE-FG03-89ER-25073)
(DE92-001629; DOE/ER-25073/T1) Avail: NTIS HC/MF A02

Progress is reported on work in the following areas: vortex dynamics and turbulence; fingers and bubbles in Hele-Shaw cells and unbounded fluid; vortex reconnection; pattern selection in solidifying systems; Richtmyer-Meshkov instability; Wavy-Taylor vortex flows; high Reynolds number laminar flows; and numerical analysis and dynamical systems. DOE

N92-15346# Los Alamos National Lab., NM.
THERM: A THREE-DIMENSIONAL TRANSIENT HEAT CONDUCTION COMPUTER PROGRAM
W. A. Cook Oct. 1991 56 p
(Contract W-7405-eng-36)
(DE92-002220; LA-12203-MS) Avail: NTIS HC/MF A04

THERM is a three-dimensional finite-element computer program for solving transient heat conduction problems. This report presents the techniques used to develop THERM. The theory described consists of a governing equation, boundary conditions, and an equivalent variational principle. The matrix equations used in THERM are derived using both vector and tensor analysis. These equations used finite-element approximations for the geometry and a finite-difference approximation for the time. THERM has finite-element formulations using both Cartesian or cylindrical coordinates. Several example problems are included to demonstrate that the THERM formulations are correct and that THERM can be used to solve meaningful problems. DOE

N92-15347# Lawrence Livermore National Lab., CA.
POLARIZABILITY CORRECTIONS IN STIMULATED RAMAN PROPAGATION
B. W. Shore, M. A. Johnson, and S. Lowder 30 Jul. 1991 40 p
(Contract W-7405-eng-48)
(DE92-002272; UCRL-ID-107966) Avail: NTIS HC/MF A03

Traditional descriptions of stimulated Raman scattering relate the various Stokes and anti-Stokes fields to the incident pump field by means of a polarizability (tensor). This description is usable for pulsed radiation but it fails when the pump carrier frequency coincides with a resonant frequency of the medium. We here describe a simple procedure for correcting the traditional polarizability approximation for pulse envelopes so as to account for effects of finite pump bandwidth. The correction amounts to the introduction of an auxiliary field envelope that incorporates pump dispersion. We apply this procedure to the equations for a degenerate, Doppler broadened ensemble of three-level atoms, in which the uppermost (virtual) level is close to resonance with the pump carrier frequency. This system becomes a two-level Raman system, but with a correction to the Raman Hamiltonian and the propagation equation. The plane-wave propagation equations presented include dispersive as well as Raman effects, and allow arbitrary combinations of field polarizations. We comment on several incidental aspects of Raman propagation, including dynamic Stark shifts, sublevel averages and fluence equations. DOE

N92-15348# Naval Postgraduate School, Monterey, CA.
NATURAL CONVECTION IMMERSION COOLING OF AN ARRAY OF HEATED PROTRUSIONS IN AN ENCLOSURE FILLED WITH DIELECTRIC LIQUID: EFFECTS OF ENCLOSURE WIDTH AND FLUID PRANDTL NUMBER M.S. Thesis
Erol Aytar Mar. 1991 176 p
(AD-A242702) Avail: NTIS HC/MF A09 CSCL 20/13

An experimental investigation of natural convection immersion cooling of an array (3 by 3 horizontally-placed heated discrete protrusions) in an enclosure filled with dielectric fluids has been conducted. Each rectangular protrusion simulates a 20 pin dual-inline-package. Effects of enclosure width and fluid Prandtl number were examined. Five different spacings from 42 mm to 7 mm and two dielectric fluids, FC-75 (Pr=25 at 27 C) and FC-43 (Pr=82 at 27 C) were used. The top boundary of the enclosure was kept constant at 10 C and the bottom boundary was insulated during the experiments. Power dissipation levels per component ranged from 0.115 W to 2.9 W. Component surface temperature measurements were used to obtain the nondimensional heat transfer parameters. In the case of FC-75 and 30 and 7 mm spacings, and in the case of FC-43 and 7 mm spacing, timewise fluctuations of temperature at steady state in several locations were recorded with increasing power level. GRA

N92-15349# Stanford Univ., CA. Environmental Fluid Mechanics Lab.
SOLUTION OF MEAN FLOW PROFILES FOR A STRATIFIED TWO-PHASE FLOW USING THE k-EPSILON TURBULENCE MODEL Final Technical Report, 15 Nov. 1989 - 15 Feb. 1991
Jonathan A. Harris and Robert L. Street Nov. 1991 32 p
(Contract N00014-90-J-1294)
(AD-A242761; SU-EFML-91-1) Avail: NTIS HC/MF A03 CSCL 08/3

This is the final technical report on a study of the surface layers at an air-water interface. A numerical model of a coupled, stratified, two-phase, turbulent flow has been developed as part of a larger study of the growth of waves under wind action. The model has been applied to the case of the coupled air-water flow in the Stanford Wind Water-Wave Research Facility. Comparison of the model results with experiments show that the model predicts mean profiles of velocity, turbulent kinetic energy, and dissipation that are in very good agreement with available data. The mean profiles generated by the model will be used as a basis for a linear-stability model of wave growth. GRA

N92-15350*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
THE EFFECTS OF SUCTION ON THE NONLINEAR STABILITY OF THE THREE-DIMENSIONAL BOUNDARY LAYER ABOVE A ROTATING DISC Final Report
Andrew P. Bassom and Sharon O. Seddougui (Birmingham Univ., England) Nov. 1991 17 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189564; ICASE-91-81; NAS 1.26:189564) Avail: NTIS HC/MF A03 CSCL 20D

There exist two types of stationary instability of the flow over a rotating disc corresponding to the upper branch, inviscid mode and the lower branch mode, which has a triple deck structure, of the neutral stability curve. A theoretical study of the linear problem and an account of the weakly nonlinear properties of the lower branch modes have been undertaken by Hall and MacKerrell respectively. Motivated by recent reports of experimental sightings of the lower branch mode and an examination of the role of suction on the linear stability properties of the flow here, the effects are studied of suction on the nonlinear disturbance described by MacKerrell. The additional analysis required in order to incorporate suction is relatively straightforward and enables the derivation of an amplitude equation which describes the evolution of the mode. For each value of the suction, a threshold value of the disturbance amplitude is obtained; modes of size greater than this threshold grow without limit as they develop away from the point of neutral stability. Author

N92-15351*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
EFFECTS OF GOERTLER VORTICES, WALL COOLING AND GAS DISSOCIATION ON THE RAYLEIGH INSTABILITY IN A HYPERSONIC BOUNDARY LAYER Final Report
Yibin Fu and Philip Hall (Manchester Univ., England) Dec. 1991 34 p Submitted for publication
(Contract NAS1-18605; AF-AFOSR-0042-89)
(NASA-CR-189577; NAS 1.26:189577; ICASE-91-87) Avail: NTIS HC/MF A03 CSCL 20D

In a hypersonic boundary layer over a wall of variable curvature, the region most susceptible to Goertler vortices is the temperature adjustment layer sitting at the edge of the boundary layer. This temperature adjustment layer is also the most dangerous site for Rayleigh instability. We investigate how the existence of large amplitude Goertler vortices affects the growth rate of Rayleigh instability. The effects of wall cooling and gas dissociation on this instability are also studied. We find that all these mechanisms increase the growth rate of Rayleigh instability and are therefore destabilizing. Author

N92-15352*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
A NEAR-WALL TWO-EQUATION MODEL FOR COMPRESSIBLE TURBULENT FLOWS Final Report
H. S. Zhang, R. M. C. So, C. G. Speziale, and Y. G. Lai (CFD Research Corp., Huntsville, AL.) Nov. 1991 38 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189565; ICASE-91-82; NAS 1.26:189565) Avail: NTIS HC/MF A03 CSCL 20D

A near-wall two-equation turbulence model of the K - epsilon type is developed for the description of high-speed compressible flows. The Favre-averaged equations of motion are solved in conjunction with modeled transport equations for the turbulent kinetic energy and solenoidal dissipation wherein a variable density extension of the asymptotically consistent near-wall model of So and co-workers is supplemented with new dilatational models. The resulting compressible two-equation model is tested in the supersonic flat plate boundary layer - with an adiabatic wall and with wall cooling - for Mach numbers as large as 10. Direct comparisons of the predictions of the new model with raw experimental data and with results from the K - omega model indicate that it performs well for a wide range of Mach numbers. The surprising finding is that the Morkovin hypothesis, where turbulent dilatational terms are neglected, works well at high Mach numbers, provided that the near wall model is asymptotically consistent. Instances where the model predictions deviate from the experiments appear to be attributable to the assumption of constant turbulent Prandtl number - a deficiency that will be addressed in a future paper. Author

N92-15353*# Mississippi State Univ., Mississippi State. Thermal and Fluid Dynamics Lab.
INVESTIGATION OF THE INFLUENCE OF A STEP CHANGE IN SURFACE ROUGHNESS ON TURBULENT HEAT TRANSFER Final Report, 1 Jan. 1990 - 30 Jun. 1991
Robert P. Taylor, Hugh W. Coleman, J. Keith Taylor, and M. H. Hosni Jun. 1991 133 p
(Grant NAG3-1116)
(NASA-CR-189531; NAS 1.26:189531) Avail: NTIS HC/MF A07 CSCL 20D

The use is studied of smooth heat flux gages on the otherwise very rough SSME fuel pump turbine blades. To gain insights into behavior of such installations, fluid mechanics and heat transfer data were collected and are reported for a turbulent boundary layer over a surface with a step change from a rough surface to a smooth surface. The first 0.9 m length of the flat plate test surface was roughened with 1.27 mm hemispheres in a staggered, uniform array spaced 2 base diameters apart. The remaining 1.5 m length was smooth. The effect of the alignment of the smooth surface with respect to the rough surface was also studied by conducting experiments with the smooth surface aligned with the bases or alternatively with the crests of the roughness elements. Stanton number distributions, skin friction distributions, and boundary layer profiles of temperature and velocity are reported and are compared to previous data for both all rough and all smooth wall cases. The experiments show that the step change from rough to smooth has a dramatic effect on the convective heat transfer. It is concluded that use of smooth heat flux gages on otherwise rough surfaces could cause large errors. Author

N92-15354*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
NO-VENT FILL PRESSURIZATION TESTS USING A CRYOGEN SIMULANT
G. R. Schmidt, R. W. Carrigan, J. E. Hahs, D. A. Vaughan, and D. C. Foust (Martin Marietta Space Systems, Inc., Huntsville, AL.) Dec. 1991 30 p
(NASA-TM-103561; NAS 1.15:103561) Avail: NTIS HC/MF A03 CSCL 20D

The results are described of an experimental program which studied the performance of various no-vent fill techniques for tank-to-tank liquid transfer. The tests were performed using a cryogen simulant (Freon-114) and a test bed consisting of a multiple tank/plumbing network that enabled studies of a variety of different inlet flow and active mixing regimes. Several results and conclusions were drawn from the 26 transfer experiments comprising the program. Most notable was the significant improvement in fill performance (i.e., minimized fill time and maximized fill fraction) with increased agitation of the liquid surface. Another was the close correlation between measured condensation rates and those predicted by recent theories which express condensation as a function of turbulent eddy effects on the liquid surface. In most cases, test data exhibited strong agreement with an analytical model which accounts for tank heat transfer and thermodynamics in a 1 g environment. Author

N92-15355# Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil).
A RELATIONSHIP BETWEEN STABILIZED FINITE ELEMENT METHODS AND THE GALERKIN METHOD WITH BUBBLE FUNCTIONS
F. Brezzi (Consiglio Nazionale delle Ricerche, Pavia, Italy), M. O. Bristeau, M. Mallet, and G. Roge 1991 25 p
(DE91-642290; LNCC-002/91) Avail: NTIS HC/MF A03

A relation between stabilized finite element methods and the Galerkin method employing interpolations with bubble functions is

established for the advective-diffusive model and for the linearized compressible Navier-Stokes equations. The bubble functions are shown to help in stabilizing the advective operator without recourse to up-winding or any other numerical strategy. In particular, for the advective-diffusive model, the Galerkin method employing piecewise linears with bubble functions is shown to be equivalent to the Streamline-Upwind/Petrov-Galerkin (SUPG) method in the diffusive limit. DOE

N92-15356# Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil).
ON THE PHYSICAL SOLUTIONS TO THE HEAT EQUATION SUBJECTED TO NONLINEAR BOUNDARY CONDITIONS
R. M. S. daGama 1990 18 p
(DE91-642292; LNCC-023/90) Avail: NTIS HC/MF A03

This work consists of a discussion on the physical solutions to the steady-state heat transfer equation, when it is subjected to nonlinear boundary conditions. It will be presented as a functional, whose minimum occurs for the (unique) physical solution to what is considered a heat transfer problem, suitable for a large class of typical (nonlinear) boundary conditions (representing the radiative/convective loss from the body to the environment). It will be demonstrated that these problems admit always one, and only one, physical solution, which represents the absolute temperature. DOE

N92-15357*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
A CRITICAL COMPARISON OF SECOND ORDER CLOSURES WITH DIRECT NUMERICAL SIMULATION OF HOMOGENEOUS TURBULENCE
Tsan-Hsing Shih and John L. Lumley (Cornell Univ., Ithaca, NY.) Nov. 1991 63 p
(NASA Order C-99066-G)
(NASA-TM-105351; ICOMP-91-25; CMOTT-91-10; E-6725; NAS 1.15:105351) Avail: NTIS HC/MF A04 CSCL 20D

Recently, several second order closure models have been proposed for closing the second moment equations, in which the velocity-pressure gradient (and scalar-pressure gradient) tensor and the dissipation rate tensor are two of the most important terms. In the literature, these correlation tensors are usually decomposed into a so called rapid term and a return-to-isotropy term. Models of these terms have been used in global flow calculations together with other modeled terms. However, their individual behavior in different flows have not been fully examined because they are un-measurable in the laboratory. Recently, the development of direct numerical simulation (DNS) of turbulence has given us the opportunity to do this kind of study. With the direct numerical simulation, we may use the solution to exactly calculate the values of these correlation terms and then directly compare them with the values from their modeled formulations (models). Here, we make direct comparisons of five representative rapid models and eight return-to-isotropy models using the DNS data of forty five homogeneous flows which were done by Rogers et al. (1986) and Lee et al. (1985). The purpose of these direct comparisons is to explore the performance of these models in different flows and identify the ones which give the best performance. The modeling procedure, model constraints, and the various evaluated models are described. The detailed results of the direct comparisons are discussed, and a few concluding remarks on turbulence models are given. Author

N92-15358*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THERMAL AND SOLUTAL CONVECTION WITH CONDUCTION EFFECTS INSIDE A RECTANGULAR ENCLOSURE
Christophe Mennetrier (Ecole Nationale Superieure des Mines, Paris, France) and Walter M. B. Duval Dec. 1991 25 p Sponsored in part by USRA
(NASA-TM-105371; E-5521; NAS 1.15:105371) Avail: NTIS HC/MF A03 CSCL 20D

We numerically investigate the effects of various boundary conditions on the flow field characteristics of the physical vapor transport process. We use a prescribed temperature profile as boundary condition on the enclosure walls, and we consider parametric variations applicable to ground-based and space microgravity conditions. For ground-based applications, density gradients in the fluid phase generate buoyancy-driven convection which in turn disrupts the uniformity of the mass flux at the interface depending on the orientation. Heat conduction in the crystal can affect the fluid flow near the interface of the crystal. When considering isothermal source and sink at the interfaces, we observe a diffusive mode and three modes (i.e., thermal, solutal, and thermo-solutal). The convective modes show opposing flow field trends between thermal and solutal convection; theoretically, these trends can be used to achieve a uniform mass flux near the crystal. However, under the physical conditions chosen, the mathematical condition necessary for uniform mass flux cannot be satisfied because of thermodynamic restrictions. When a longitudinal thermal gradient is prescribed on the boundary of the crystal, a non-uniform interface temperature results, which induces a symmetrical fluid flow near the interface for the vertical case. For space microgravity applications, we show that the flow field is dominated by the Stefan wind and a uniform mass flux results at the interface. Author

N92-14976# Centre d'Etudes et de Recherches Anthropologie d'Appliquee, Paris (France). Aerodynamics Dept.
HYPERSONIC BOUNDARY LAYERS: TRANSITION AND TURBULENCE EFFECTS
D. Arnal and B. Aupoix *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 25-38 Previously announced in IAA as A89-25860 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15026# Vrije Univ., Brussels (Belgium). Dept. of Fluid Dynamics.
A MULTIBLOCK/MULTIGRID CODE FOR THE EFFICIENT SOLUTION OF COMPLEX 3D NAVIER-STOKES FLOWS
C. Hirsch, C. Lacor, A. Rizzi, P. Eliasson, I. Lindblad, and J. Haeuser (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 415-420 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15027# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.). Aerodynamics Dept.
COMPUTATIONAL AEROTHERMODYNAMIC METHODS FOR INDUSTRIAL APPLICATIONS TO RE-ENTRY AND HYPERSONIC CRUISE PROBLEMS
H. Rieger, H. Stock, and B. Wagner *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 421-437 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15029# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL SIMULATION OF THERMOCHEMICAL NON-EQUILIBRIUM VISCOUS FLOWS AROUND REENTRY BODIES
F. Coquel, V. Joly, C. Marmignon, and C. Flament (Ohio State Univ., Columbus.) *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 447-452 Previously announced in IAA as A91-45648 Sponsored by Direction des Recherches, Etudes et Techniques (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15030# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EQUILIBRIUM SOLUTION OF THE EULER AND NAVIER-STOKES EQUATIONS AROUND A DOUBLE ELLIPSOIDAL SHAPE WITH MONO- AND MULTI-BLOCKS INCLUDING REAL GAS EFFECTS, PART 1
H. Wong and J. Haeuser *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 453-458 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15033# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
PARALLELIZATION OF A DIRECT SIMULATION MONTE CARLO (DSMC) CODE FOR FLUID DYNAMICS
Giulio Prisco *In its* Aerothermodynamics for Space Vehicles Jul. 1991 p 477-482 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15034# Laboratoire d'Aerothermique du CNRS, Meudon (France).
DSMC CALCULATION OF A COMPRESSION CORNER FLOW
Jean-Claude Lengrand *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 483-488 (For primary document see N92-14973 06-02)
(Contract DRET-89-080)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15038# Aerospatiale, Paris (France).
INFLUENCE OF TRAPPED GAS ON WATER HAMMER EFFECTS IN TUBE
M. Bouton *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 509-513 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15084*# CFD Research Corp., Huntsville, AL.
DEVELOPMENT OF A CFD CODE FOR ANALYSIS OF FLUID DYNAMIC FORCES IN SEALS
Mahesh M. Athavale, Andrzej J. Przekwas, and Ashok K. Singhal *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 27-39 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 20D

N92-15893*# Florida Univ., Gainesville. Dept. of Aerospace Engineering, Mechanics and Engineering Science.
DEVELOPMENT OF A PRESSURE BASED MULTIGRID SOLUTION METHOD FOR COMPLEX FLUID FLOWS
Wei Shyy *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20D

N92-15902*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
ASSESSMENT OF THE NASA CODE FDNS2D FOR COMPUTATION OF FILM COOLING EFFECTIVENESS
Keith A. Woodbury *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N92-15359# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
DEVELOPMENT AND INVESTIGATION OF SILICON MICROSTRIP DETECTORS
I. P. Barkov, I. M. Gazizov, V. A. Stankevich (Rizhskij Nauchno-Issledovatelskij Inst., Riga, USSR), L. L. Kurchaninov, V. V. Rykalin, and A. I. Sarajkin 1990 8 p In RUSSIAN; ENGLISH summary Submitted for publication
(DE91-639488; IFVE-OEF-90-65) Avail: NTIS HC/MF A02

This paper describes the process of constructing silicon microstrip detectors. The characteristics of the detectors are investigated. The leakage current of a diode element in the case of total depletion is not higher than 10 nA. The signal-to-noise ratio is about 6 if preamplifiers with a time constant of approximately 20 ns are used. DOE

N92-15360# Technische Univ., Brunswick (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik.
ACOUSTIC FLOWMETERS: THEIR APPLICATIONS IN HYDRAULICS Ph.D. Thesis [AKUSTISCHE DURCHFLUSSMESSGERAETE UND DEREN ANWENDUNG IN DER HYDRAULIK]
Ulf Nitzsche 1990 127 p In GERMAN
(ETN-92-90593) Avail: NTIS HC/MF A07

Flowmeter installations for viscous and high hydrostatic pressure media are developed. Their usability is considered for characteristic measuring tasks in the field of oil hydraulics. The properties of flow sensors are evaluated by system analysis. Acoustic measuring systems are preferred. Two ultrasonic flowmeters are realized. Simulation models, installation with piezoceramic material parameters, and sound visualization support these developments. A computer aided hydraulic test stand is developed in order to detect the measuring characteristics of this system. Flowmeter applications are shown using the identification of the static and dynamic parameters of an electrohydraulic pilot valve. ESA

N92-15361 National Physical Lab., Teddington (England). Div. of Electrical Science.
RECEIVER NOISE AND THE PRECISION MEASUREMENT OF MISMATCHED NOISE SOURCES
Gareth L. Williams (Royal Signals and Radar Establishment, Malvern, England) Nov. 1990 63 p
(NPL-DES-103; ISSN-0143-7305; ETN-92-90715) Copyright
Avail: National Physical Lab., Teddington, TW11 OLW, England

A theory and procedure which enables noise sources to be calibrated accurately, with neither tuners nor isolators, is presented. To achieve the best accuracy in calibrating noise sources in the absence of isolators, allowance must be made for the effect of source impedance on amplifier noise. Four topics are considered: a technique for analyzing the effect of mismatched components on receiver noise in a microwave radiometer (scattering parameters are used to describe the network connected between source and receiver); the application of the theory to radiometer analysis; procedure for calibrating noise sources without isolators; and experimental results. Equations are presented for the accurate embedding and de-embedding of the noise parameters of an amplifier in a cascade of lossy two-ports from a knowledge of the parameters of the two-ports. No presumptions are made regarding the match of any of the components. ESA

N92-15362# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CYCLE COUNTING FUNCTION OF TSI 1990A AND 1980 LDV PROCESSORS AS A MEANS OF PARTICLE TRANSIT TIME MEASUREMENT
F. Leprince Jun. 1991 60 p
(VKI-TN-177; ETN-92-90716) Avail: NTIS HC/MF A04

The main objectives are to study the dependence of the number of counted cycles on signal level, and to check that the cycle counting process is independent of the Doppler frequency. Tests of TSI 1990A and 1980 counters are performed with different kinds of stimulated signals generated by function generators. Measurements show that the number of counted cycles depends on the ratio of signal to threshold detector levels in a predictable way. The cycle counting process is not frequency dependent. Indirect accuracy limitations will arise from the dispersion introduced by the effect of signal level. Major difficulties were encountered because the signals used for test purposes were different from actual laser Doppler velocimetry (LVD) signals, causing wrong cycle counts: occurrence of end of burst failure due to improper signal shape, and interference of the dead time of the processor with cycle counting. Other difficulties are related with signal shape imperfections. In actual measurements errors of the same kind are likely to occur owing to the lack of validation of cycle counts. Requirements for a suitable cycle counting processor, and the conditions of proper signal generation for testing Doppler processors are defined. ESA

N92-15363# Sandia National Labs., Albuquerque, NM.
CALIBRATION OF A HOPKINSON BAR WITH A TRANSFER STANDARD
V. I. Bateman, W. B. Leisher, F. A. Brown, and N. T. Davie 1991 10 p Presented at the 62nd Shock and Vibration Symposium, Springfield, VA, 29-31 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-002348; SAND-91-1131C; CONF-9110189-4) Avail: NTIS HC/MF A02

During the past year, program field test temperatures, that are beyond the test accelerometer operational limits of -30 and +150 F, required the calibration of accelerometers at high shock levels and at the temperature extremes of -50 and +160 F. The purposes of these calibrations were to insure the accelerometers operated at the field test temperatures and to provide an accelerometer sensitivity at each test temperature. Since there is no NIST-traceable (National Institute of Standards and Technology traceable) calibration capability at shock levels of 5,000 to 15,000 g for the temperature extremes of -50 and +160 F, a method for calibrating and certifying the Hopkinson bar with a transfer standard was developed. Time domain and frequency domain results are given that characterize the Hopkinson bar. The NIST accuracy for the standard accelerometer in shock is + or - 5 pct. The Hopkinson bar has been certified by the Sandia Secondary Standards Division with an uncertainty of 6 pct. DOE

N92-15364# Oak Ridge National Lab., TN.
HEAT-FLUX GAGE THERMOPHOSPHOR SYSTEM
K. W. Tobin Aug. 1991 75 p
(Contract DE-AC05-84OR-21400)
(DE92-002383; ORNL/ATD-59) Avail: NTIS HC/MF A04

This document describes the installation, hardware requirements, and application of the Heat-Flux Gage (Version 1.0) software package developed by the Oak Ridge National Laboratory, Applied Technology Division. The developed software is a single component of a thermographic phosphor-based temperature and heat-flux measurement system. The heat-flux transducer was developed by EG&G Energy Measurements Systems and consists of a 1 x 1 in. polymethylpentene sheet coated on the front and back with a repeating thermographic phosphor pattern. The phosphor chosen for this application is gadolinium oxysulphide doped with terbium. This compound has a sensitive temperature response from 10 to 65.6 C (50 to 150 F) for the 415- and 490-nm spectral emission lines. DOE

N92-15365# Naval Research Lab., Washington, DC.
ANALYSIS OF THE DEFLECTION SYSTEM FOR A MAGNETIC-FIELD-IMMERSED MAGNICON AMPLIFIER
B. Hafizi, Y. Seo, S. H. Gold, W. M. Manheimer, and P. Sprangle 5 Nov. 1991 26 p
(AD-A242433; NRL-MR-6793) Avail: NTIS HC/MF A03 CSCL 09/1

A linear analysis of the electron beam deflection system in a magnicon is presented. The system consists of identical cavities, one driven and the remainder passive, separated by a drift space, and immersed in an axial magnetic field. The cavities contain a rotating TM 110 mode. The length of each cavity is pi nu sub z/omega and that of the drift space is pi nu sub z/omega sub c where omega is the RF frequency, omega sub c is the relativistic gyrofrequency in the guide field and nu sub z is the mean axial velocity of the beam electrons. The linearized electron orbits are obtained for arbitrary initial axial velocity, radial coordinate and magnetic field. The small signal gain and the phase shift are determined. The special case where omega sub c/ omega = 2 has unique features and is discussed in detail. For example, this special case gives rise to a constant phase of the electrons relative to that of the TM 110 mode and the passive cavity may be driven optimally for a given beam current. For this magnicon design, a power gain of 10 dB per passive cavity is feasible. Operation of the output cavity at the fundamental and high harmonics of the input drive frequency is briefly discussed. GRA

N92-15366*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AN OPTICAL METHOD FOR DETERMINING LEVEL IN TWO-PHASE CRYOGENIC FLUIDS
Lawrence G. Oberle and Donald H. Weikle Jan. 1992 12 p Original contains color illustrations
(NASA-TM-104524; E-6398; NAS 1.15:104524) Avail: NTIS HC/MF A03; 2 functional color pages CSCL 14B

A method was evaluated to measure the liquid-gas and the liquid-slush interfaces in two-phase cryogen systems using optical means. This method makes use of the attenuation of a directed light beam caused by the difference in the index of refraction between the solid particles and the surrounding liquid. Preliminary experimental results obtained in slush nitrogen are shown. The possibility of extending this technique to include a measure of solid fraction is also discussed. Author

N92-15004# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Div. de Thermophysique.
ABLATION AND TEMPERATURE SENSORS FOR FLIGHT MEASUREMENTS IN REENTRY BODY HEAT SHIELDS
J. J. Cassaing, D. L. Balageas, A. A. Deom, and J. C. Lestel *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 241-246 Sponsored in part by CEA and Aerospatiale (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

N92-15467*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SELECTION OF REPRESENTATIVE INSTRUMENTS FOR A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
Warren D. Hypes, Lloyd Keafer, Rogard T. Ross, Heather R. Knight (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.), Anthony Jalink, and Cheryl L. Allen *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 109-179 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 14B

N92-15475*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PHYSICAL AND PERFORMANCE CHARACTERISTICS OF INSTRUMENTS SELECTED FOR GLOBAL CHANGE MONITORING
Cheryl L. Allen *In its* Global Change Technology Architecture

Trade Study Sep. 1991 p 351-379 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N92-15367# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
FERRUNDI COMPANY SUPPLIES 4500 MODEL HEAD UP DISPLAY DEVICES TO INDIA'S MIG-21 AIRCRAFT
25 Jul. 1991 6 p Transl. into ENGLISH from Guoji Hangkong (China), no. 7, 1985 p 52-53
(AD-A241044; FTD-ID(RS)T-0172-91) Avail: NTIS HC/MF A02 CSCL 09/5

The 4500 Model head up display device is a type which is produced by the Ferrundi Company. It is a light weight head up display device and weapon aiming system which is capable of being supplied for retrofit use. the display device is a conventional non-holographic system which is capable of supplying a 25 degree circumference field of vision and uses direct or alternating current power sources. The system also possesses auto-supervision and control as well as automatic measurement and testing functions. GRA

N92-15368# California Univ., Berkeley. Lawrence Berkeley Lab.
THREE-DIMENSIONAL SIMULATION OF A HOLE-COUPLED FEL OSCILLATOR
S. Krishnagopal, M. Xie, Kwang-Je Kim, and A. Sessler Aug. 1991 15 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 191
(Contract DE-AC03-76SF-00098)
(DE92-000810; LBL-31196; ESG-152; CONF-9108118-9) Avail: NTIS HC/MF A03

The performance of a two-mirror resonator with holes for out-coupling has been examined in a previous study in which the Free Electron Laser (FEL) gain was neglected, but the geometrical effect of the wiggler aperture was included in the optical calculation. The phenomenon of mode degeneracy was found to occur. Mode degeneracy has serious implications for the stability of performance when the FEL gain is included. We have developed a FEL oscillator code based on TDA, a three-dimensional FEL amplifier code, to study the mode characteristics in the presence of an FEL. We find that the interaction of the radiation and the FEL has an important, and positive, impact on the mode-profile and related cavity performance parameters. In particular, mode degeneracy is not expected to be a serious problem for reasonable FEL oscillator designs. DOE

N92-15369# California Univ., Berkeley. Lawrence Berkeley Lab.
FREE-ELECTRON LASER GENERATION OF VUV AND X RAY RADIATION USING A CONDITIONED BEAM AND ION-CHANNEL FOCUSING
Li-Hua Yu (Brookhaven National Lab., Upton, NY.), A. Sessler, and D. H. Whittum 30 Aug. 1991 15 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contracts DE-AC03-76SF-00098; DE-AC02-76CH-00016)
(DE92-000957; LBL-31198; CONF-9108118-12) Avail: NTIS HC/MF A03

The use of ion-focusing and a conditioned beam greatly enhances the gain of a Free Electron Laser (FEL) in the VUV and Soft X-Ray range. The equations governing FEL amplification are derived and results of a linear analysis are noted. Numerical results, including 3D effects and having an order of magnitude improvement in gain, are presented for a 30 Angstrom example. DOE

N92-15370# Brookhaven National Lab., Upton, NY.
RESONATOR DESIGN FOR A VISIBLE WAVELENGTH FREE-ELECTRON LASER
A. Bhowmik, N. Lordi (Rockwell International Corp., Canoga Park, CA.), I. Ben-Zvi, and J. Gallardo 1990 25 p Presented at the International Conference on Lasers 1990, San Diego, CA, 10-14 Dec. 1990
(Contract DE-AC02-76CH-00016)
(DE92-001779; BNL-46644; CONF-901263-11) Avail: NTIS HC/MF A03

Design requirements for a visible wavelength free-electron laser being developed at the Accelerator Test Facility at Brookhaven National Laboratory are presented along with predictions of laser performance from 3-D numerical simulations. The design and construction of the optical resonator, its alignment, and its control systems are described. DOE

N92-15371# Brookhaven National Lab., Upton, NY.
PROPOSED UV-FEL USER FACILITY AT BNL
I. Ben-Zvi, L. F. DiMauro, S. Krinsky, M. G. White, L. H. Yu, K. Batchelor, A. Friedman, A. S. Fisher, H. Halama, and G. Ingold et al 1991 15 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract DE-AC02-76CH-00016)
(DE92-002080; BNL-46689; CONF-9108118-14) Avail: NTIS HC/MF A03

The NSLS at Brookhaven National Laboratory is proposing the construction of a UV-FEL operating in the wavelength range from visible to 750 A. Nano-Coulomb electron pulses will be generated at a laser photo-cathode RF gun at a repetition rate of 10 KHz. The 6 ps pulses will be accelerated to 250 MeV in a superconducting linac. The FEL output will serve four stations with independent wavelength tuning, using two wigglers and two rotating mirror beam switches. Seed radiation for the FEL amplifiers will be provided by conventional tunable lasers, and the final frequency multiplication from the visible or near UV to the VUV will be carried out in the FEL itself. Each FEL will be comprised of an initial wiggler resonant to the seed wavelength, a dispersion section, and a second wiggler resonant to the output wavelength. The facility will provide pump probe capability, FEL on FEL, and FEL on synchrotron light from an insertion device on the NSLS x-ray ring. DOE

N92-15372# Lawrence Livermore National Lab., CA.
AMPLIFICATION OF A BI-PHASE SHIFT-KEY MODULATED SIGNAL BY A mm-WAVE FEL
D. Prosnitz, E. T. Scharlemann, and M. K. Sheaffer Oct. 1991 16 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract W-7405-eng-48)
(DE92-002177; UCRL-JC-107200; CONF-9108118-18) Avail: NTIS HC/MF A03

Bi-phase shift keying (BPSK) is a modulation scheme used in communications and radar in which the phase of a transmitted RF signal is switched in a coded pattern between discrete values differing by (pi) radians. The transmitted information rate (in communications) or resolution (in imaging radar) depends on the rate at which the transmitted signal can be modulated. Modulation rates of greater than 1 GHz are generally desired. Although the instantaneous gain bandwidth of a mm-wave FEL amplifier can be much greater than 10 GHz, slippage may limit the BPSK modulation rate that can be amplified. Qualitative slippage arguments would limit the modulation rate to relatively low values; nevertheless, simulations with a time-dependent FEL code (GINGER) indicate that rates of 2 GHz or more are amplified without much loss in modulation integrity. In this paper we describe the effects of slippage in the simulations and discuss the limits of simple arguments. DOE

N92-15373# Lawrence Livermore National Lab., CA.
PREDICTED PERFORMANCE OF AN INDUCTION LINAC DRIVEN FEL AMPLIFIER DESIGNED FOR RADAR APPLICATIONS AT 94 GHz

M. Caplan Aug. 1991 13 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract W-7405-eng-48)
(DE92-002183; UCRL-JC-107204; CONF-9108118-17) Avail: NTIS HC/MF A03

The saturated performance of an Induction Linac Driven FEL operating at 94 GHz with peak microwave powers in excess of 2 GW is evaluated using a self-consistent 3-D waveguide mode-particle interaction code. The code includes the effect of AC longitudinal space charge and DC transverse space charge with the resulting prediction that operation is not possible below 2.5 MeV with a 2 kA beam and 10 cm wiggler. A design based around a 4 MeV beam predicts peak power in excess of 2.4 GW over a 10 pct. bandwidth with output phase varying linear with frequency. DOE

N92-15374# California Univ., Berkeley. Lawrence Berkeley Lab.
FEL GAIN TAKING INTO ACCOUNT DIFFRACTION AND ELECTRON BEAM EMITTANCE; GENERALIZED MADEY'S THEOREM
Kwang-Je Kim Aug. 1991 10 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract DE-AC03-76SF-00098)
(DE92-002262; LBL-30628; CONF-9108118-20) Avail: NTIS HC/MF A02

We derive a formula for the free electron laser gain in the small-signal, low-grain regime which resembles closely the 1-D formula but taking into account the effect of wave diffraction and electron beam divergence and betatron motion. The formula is cast in a form which exhibits clearly the role of the transverse phase space distribution of photons and electrons. DOE

N92-15375# Los Alamos National Lab., NM.
ELECTRON-BEAM SENSITIVITY STUDY OF THE LOS ALAMOS ADVANCED FREE-ELECTRON LASER BEAM LINE
S. Hartman (California Univ., Los Angeles.), A. Lombardi, R. Sheffield, and Tai-Sen Wang 1991 15 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract W-7405-eng-36)
(DE92-002453; LA-UR-91-3266; CONF-9108118-24) Avail: NTIS HC/MF A03

A sensitivity study that used the particle tracking code PARMELA was performed on the Advanced Free-Electron Laser (AFEL). The tolerances on the alignment of the beam-line elements and the magnetic-field strengths were examined. Two base-line configurations were determined at the beginning of the study. The electron beam was then matched into the wiggler. The optimized beam-line parameters were varied independently and their sensitivities were judged with the criterion that the free-electron laser (FEL) effective-detuning parameter should not fluctuate more than 10 pct. The results of this study set the specifications for the alignment, for the sensitivity of the steering magnets, and for the accuracy of the magnetic field in the quadrupoles and dipoles. DOE

N92-15376# University of Central Florida, Orlando. Center for Research in Electro-Optics and Lasers.
[CREOL SCIENTIFIC SUPPORT TO ISTEF IN DEVELOPING AND TESTING INNOVATIVE LASER RADAR TECHNIQUES AND INSTRUMENTATION FOR THE DISCRIMINATION AND TRACKING OF BOOSTERS, PBVs, AND MIDCOURSE TARGETS] Final Report, 1 Apr. 1989 - 31 Dec. 1990
Jul. 1991 58 p
(Contract N00014-89-K-0125)
(AD-A242751) Avail: NTIS HC/MF A04 CSCL 17/9

The purpose of this program was to provide support to the Innovative Science and Technology Experimental Facility (ISTEF) in developing and testing innovative laser radar techniques and instrumentation for the discrimination and tracking of boosters, post-boost vehicles (PBV), and mid-course targets. Under this contract, specific Center for Research in Electro-Optics and Lasers (CREOL) support to ISTEF included the following four tasks: Task 1, One Micron Coherent Laser Radar; Task 2, Atmospheric Seeing Measurements; Task 3, Atmospheric Induced Enhanced Backscatter Characterization; and Task 4, IR Focal Plane Array Testing. GRA

N92-15377# Georgia Inst. of Tech., Atlanta. School f Mechanical Engineering.
LASER-DOPPLER TECHNIQUES FOR SENSING OF COMPRESSIONAL WAVES Final Report
18 Oct. 1991 16 p
(Contract N00014-87-K-0021)
(AD-A242803) Avail: NTIS HC/MF A03 CSCL 17/5

A differential laser Doppler velocimeter (LDV) has been assembled and tested to provide noninvasive absolute measurements of acoustic particle displacements of standing waves generated in a water-filled tube. The principle of the technique is to measure the Doppler shift of laser light scattered from colloidal microparticles oscillating under the action of an acoustic field. The system tested is capable of detecting particle displacements of the order of a few nanometers with a bandwidth of several kilohertz. The performances and limitations of the system are discussed. In particular, the effect of Brownian motion is shown to produce only negligible broadening of the spectral density of the signal of interest. The sensitivity of the present LDV system is estimated to be very close to the shot noise limit of the photomultiplier tube used to detect the Doppler shift of the scattered light. Experimental results are obtained under the controlled laboratory situations with calibrated microparticles of radii 10, 1, and 0.1 microns in suspension in very pure (reverse osmosis) water. GRA

N92-15378*# Illinois Univ. at Urbana-Champaign, Savoy. Electro-Optic Systems Lab.
RANGING PERFORMANCE OF SATELLITE LASER ALTIMETERS
Chester S. Gardner Jan. 1992 33 p
(Grant NsG-5049)
(NASA-CR-189454; NAS 1.26:189454; UILU-ENG-92-2547; EOSL-92-001) Avail: NTIS HC/MF A03 CSCL 20E

Topographic mapping of the earth, moon and planets can be accomplished with high resolution and accuracy using satellite laser altimeters. These systems employ nanosecond laser pulses and microradian beam divergences to achieve submeter vertical range resolution from orbital altitudes of several hundred kilometers. Here, we develop detailed expressions for the range and pulse width measurement accuracies and use the results to evaluate the ranging performances of several satellite laser altimeters currently under development by NASA for launch during the next decade. Our analysis includes the effects of the target surface characteristics, spacecraft pointing jitter and waveform digitizer characteristics. The results show that ranging accuracy is critically dependent on the pointing accuracy and stability of the altimeter especially over high relief terrain where surface slopes are large. At typical orbital altitudes of several hundred kilometers, single-shot accuracies of a few centimeters can be achieved only when the pointing jitter is on the order of 10 mu rad or less. Author

N92-15379# International Centre for Theoretical Physics, Trieste (Italy).
REAL TIME REFRACTIVE INDEX MEASUREMENT BY ESPI
R. Torroba and C. Joenathan Mar. 1991 15 p
(DE91-641595; LAMP-91/1) Avail: NTIS HC/MF A03

In this paper, a method to measure refractive index variations in real time is reported. A technique to introduce reference fringes in real time is discussed. Both the theoretical and experimental results are presented, and an example with phase shifting is given. DOE

N92-15380# Nagoya Univ. (Japan). Plasma Science Center.
TWO-FREQUENCY OPERATION OF A HYBRID TEA CO2 LASER AND ITS APPLICATION TO TWO-FREQUENCY PULSE INJECTION LOCKING
Koichi Sasaki, Hirotaka Ohno, Takaharu Fujii (Nagoya Univ., Japan), and Takashige Tsukishima Oct. 1990 16 p
(DE91-780195; PSC-11) Avail: NTIS HC/MF A03

Simultaneous two-frequency oscillation of a hybrid TEA CO2 laser is exhibited when the cw section is operated in a 'below threshold' state. The output of the hybrid laser thus obtained is injected into a main TEA CO2 laser to obtain a power-modulated, long-pulsed output with a well suppressed gain-switched spike.
DOE

N92-15381# Brookhaven National Lab., Upton, NY.
THE FRESH-BUNCH TECHNIQUE IN FELs
I. Ben-Zvi, K. M. Yang, and L. H. Yu 1991 13 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract DE-AC02-76CH-00016)
(DE92-002066; BNL-46688; CONF-9108118-16) Avail: NTIS HC/MF A03

The 'Fresh Bunch' technique is being proposed as a method of increasing the gain and power of FEL amplifiers in which the length of the optical radiation pulse is shorter than the length of the electron bunch. In multi-stage FEL, electron beam energy spread is increased by the FEL interaction in the early stages. In the 'Fresh Bunch' technique, the low energy spread of the electron beam is recovered by shifting the radiation pulse to an undisturbed part of the electron bunch, thus improving the gain and trapping fraction in later stages. A test case for the application of the Fresh Bunch method is demonstrated by numerical simulation. In this particular example, we examine a subharmonically seeded VUV free electron laser. We begin with the generation of harmonic radiation, which takes place over one part of the electron bunch. Then the radiation is shifted by means of a strong dispersive section to a fresh part of the bunch for exponential amplification and tapered wiggler amplification. By starting over with a new ensemble of electrons, the energy spread introduced by the bunching in the fundamental is removed, leading to an increased gain. Furthermore, it is possible to use a much stronger seed in the fundamental without incurring the penalty of a large energy spread later on. We note that more than a single application of the 'Fresh Bunch' method may be done in a single FEL multiplier-amplifier. Thus, x-ray wavelengths may be reached by successive multiplication in a chain of FEL amplifiers starting from a tunable seed laser.
DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N92-15382# Argonne National Lab., IL.
MAGLEV SYSTEM DESIGN CONSIDERATIONS
H. T. Coffey 1991 10 p Presented at the 1991 Society of Automotive Engineers (SAE) Future Transportation Technology Conference, Portland, OR, 5-8 Aug. 1991
(Contract W-31-109-eng-38)
(DE92-000239; ANL/CP-73909; CONF-9108115-2) Avail: NTIS HC/MF A02

Although efforts are now being made to develop magnetic levitation technologies in the United States, they have been underway for two decades in Germany and Japan. The characteristics of maglev systems being considered for implementation in the United States are speculative. A conference was held at Argonne National Laboratory on 28-29 Nov. 1990, to discuss these characteristics and their implications for the design requirements of operational systems. This paper reviews some of the factors considered during that conference.
DOE

N92-15383# Oak Ridge National Lab., TN.
SCALE EFFECTS IN SLIDING FRICTION: AN EXPERIMENTAL STUDY
P. J. Blau 24 Jul. 1991 20 p Presented at the North American Treaty Organization (NATO) Advanced Study Institute Meeting on Fundamentals of Friction, Braunlage, Fed. Republic of Germany, 29 Jul. - 9 Aug. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000683; CONF-9107181-1) Avail: NTIS HC/MF A03

Solid friction is considered by some to be a fundamental property of two contacting materials, while others consider it to be a property of the larger tribosystem in which the materials are contained. A set of sliding friction experiments were designed to investigate the hypothesis that the unlubricated sliding friction between two materials is indeed a tribosystems-related property and that the relative influence of the materials properties or those of the machine on friction varies from one situation to another. Three tribometers were used: a friction microprobe (FMP), a typical laboratory-scale reciprocating pin-on-flat device, and a heavy-duty commercial wear tester. The slider material was stainless steel (AISI 440C) and the flat specimen material was an ordered alloy of Ni3Al (IC-50). Sphere-on-flat geometry was used at ambient conditions and at normal forces ranging from 0.01 N to 100 N and average sliding velocities of 0.01 to 100.0 mm/s. The nominal, steady-state sliding friction coefficient tended to decrease with increases in normal force for each of the three tribometers, and the steady state value of sliding friction tended to increase as the mass of the machine increased. The variation of the friction force during sliding was also a characteristic of the test system. These studies provide further support to the idea that the friction of both laboratory-scale and engineering tribosystems should be treated as a parameter which may take on a range of characteristic values and not conceived as having a single, unique value for each material pair.
DOE

N92-15384# David Taylor Research Center, Bethesda, MD.
DEVELOPMENT AND TESTING OF A HYDROPNEUMATIC SUSPENSION SYSTEM ON A USMC AAV7A1 Final Report, Jan. 1988 - Jul. 1991
Susan M. Stack 30 Jul. 1991 307 p
(Contract N00167-88-C-0024)
(AD-A242468; DTRC-SD-DR-17/91) Avail: NTIS HC/MF A14 CSCL 13/6

This report discusses development, fabrication, and testing of an externally mounted, in-arm hydropneumatic suspension system on a United States Marine Corp (USMC) tracked amphibious vehicle (model AAV7A1). The suspension system was developed for a 60,000 pound vehicle and tested for performance and durability at the USMC Amphibian Vehicle Test Branch. This report contains test data and analysis resulting from this testing, in addition to contractor test results obtained. The contractor completed and documented in this report a feasibility effort to demonstrate retractability of this type suspension for future USMC amphibious vehicles. This report contains information on a digital ride quality meter fabricated by the contractor for use on this program. Testing under this program did not result in ride quality data being taken.
GRA

N92-15385# Solar Turbines, Inc. San Diego, CA.
HIGH-TEMPERATURE COMBUSTOR AND SEAL FOR A WATER PISTON PROPULSOR Final Report, Jun. 1985 - Mar. 1991
M. A. Galica and R. T. LeCren Mar. 1991 61 p
(Contract N00167-85-C-0042; NR Proj. C31-50)
(AD-A242493; SR90-R-5253-76; DTRC/SD-CR-16/91) Avail: NTIS HC/MF A04 CSCL 21/2

The detailed design and testing of a high temperature combustor and seal for a water piston propulsor is reported. The system is comprised of a high pressure combustor together with a carbon graphite rotor-contacting face seal. Analyses are presented to support the design of an air cooled combustor liner. The seal is pneumatically loaded against the rotor face using a variable pressure. Superalloy materials are selected for most

components with a vitreous enamel corrosion resistant coating applied to the high-temperature combustor liner. The combustor was subjected to a series of rig tests to define its performance prior to integrating it with the rotor system. A simulated rotor test was also conducted to study the seal plate bellows pressure relationship required to attain a satisfactory seal. After the solar combustion and seal system was integrated with the rotor system, three series of water channel tests were conducted to determine the overall system performance. The combustor performed satisfactorily although the imposed operating conditions, i.e., pressure and air flow, were significantly different from the original design specifications, requiring the combustor to operate at higher combustor loadings. The tested propulsion efficiency of the WPP was lower than predicted. An attempt to improve performance by matching the shape of the combustor outlet to the rotor passage inlet yielded minimal improvements. GRA

N92-15386# Coordinating Research Council, Inc., Atlanta, GA.
OCTANE REQUIREMENT INCREASE OF 1988 AND 1989 MODEL VEHICLES
Aug. 1991 33 p
(AD-A242615; CRC-576) Avail: NTIS HC/MF A03 CSCL 21/4

The need to study octane requirement increase (ORI) with unleaded gasolines became evident in 1970 when manufacturers announced that future cars would require catalytic converters to meet 1975 emissions standards and these vehicles would use an unleaded fuel of at least 91 RON. The Coordinating Research Council, Inc. (CRC) initiated a series of ORI programs in 1971 to study the effects of these vehicle, fuel, and emissions changes. Since that time, manufacturers have made many engine and vehicle changes to meet both emissions and fuel economy standards. Because of these continuing changes and the exclusive use of unleaded gasoline in new vehicles, the ORI programs have been discontinued. The ORI data from 1971 and 1973 through 1984 models have been reported in previous CRC publications. CRC sponsored a Society of Automotive Engineers (SAE) paper which reported 1985-1988 model data. GRA

N92-15387# Naval Postgraduate School, Monterey, CA.
SLIDING CONTROL DESIGN AND IMPLEMENTATION ON A SINGLE-LINK FLEXIBLE ARM M.S. Thesis
Chieh-Chuan Feng Dec. 1990 129 p
(AD-A242714) Avail: NTIS HC/MF A07 CSCL 20/11

The sliding model control is known as a robust control that is able to work under the uncertainties of modeling error and the environmental disturbances. The objective of this research is to design the simple control (sliding control) algorithms for a single-link flexible arm and to study the robustness due to varying payload. A general form of physical plant in state space is formulated. To achieve a continuous control, a time-varying boundary layer was introduced into the control system neighboring the sliding surface. The computer simulation program was coded in MATLAB. A low-cost IBM-AT micro-computer was utilized to implement the sliding control on the flexible arm system. Author (GRA)

N92-15388# Japan Atomic Energy Research Inst., Tokyo.
NUMERICAL SIMULATION OF BIPED LOCOMOTION ROBOT
Etsuo Kume (Japan Atomic Energy Research Inst., Tokai.) Mar. 1991 89 p In JAPANESE; ENGLISH summary
(DE91-508090; JAERI-M-91-047) Avail: NTIS HC/MF A05

The Human Acts Simulation Program (HASP) has been performed since 1987 at JAERI. In this program, a human-shaped robot reads and understands instructions written in natural languages such as Japanese, planning and producing a required sequence of actions, approach to a device or an instrument recognizing its entity and does the ordered work for plant maintenance. All of these processes are simulated by logical and numerical computations. The major aim of the HASP is to develop fundamental technologies for the design of intelligent robots. This report will describe the simulation methods and results of a human-shaped robot motions. The simulation methods of the robot's arms and robot's start and stop motions have been newly developed based on the steady walking model with fixed arms developed by M. Vukobratovic. The influence of arm motions to the stable walking and the continuous connection from start to steady walking, etc. will be discussed. DOE

N92-15083*# Mechanical Technology, Inc., Latham, NY.
INDUSTRIAL CODE DEVELOPMENT
Wilbur Shapiro *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 15-26 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15087*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SEALS RELATED RESEARCH AT NASA. LEWIS RESEARCH CENTER
Robert C. Hendricks *In its* Seals Flow Code Development Mar. 1991 p 53-65 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15088*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
NASA. MARSHALL SPACE FLIGHT CENTER HYDROSTATIC BEARING ACTIVITIES
Theodore G. Benjamin *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 67-73 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15089*# Army Propulsion Lab., Cleveland, OH.
ARMY RESEARCH CONCERNS IN ENGINE SEALING
Robert C. Bill *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 75-82 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15090*# Texas A&M Univ., College Station. Turbomachinery Lab.
SEALS RESEARCH AT TEXAS A/M UNIVERSITY
Gerald L. Morrison *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 83-100 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15091*# Akron Univ., OH.
SEALS RESEARCH AT THE UNIVERSITY OF AKRON Abstract Only
M. Jack Braun *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 101 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15092*# Air Force Systems Command, Wright-Patterson AFB, OH. Lubrication Branch.
PROGRAMS AT WRIGHT-PATTERSON AIR FORCE BASE
Ron Dayton *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 103-106 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15093*# Detroit Diesel Allison, MI.
SEAL DEVELOPMENT ACTIVITIES AT ALLISON TURBINE DIVISION Abstract Only
John Munson *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 107 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15094*# General Electric Co., Cincinnati, OH.
AREAS OF SEAL R/D AT GE
A. Nelson Pope *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 109-112 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15095*# Edgerton, Germeshausen and Grier, Inc., Wellesley, MA. Fluid Components Technology Group.
SEAL RELATED DEVELOPMENT ACTIVITIES AT EG/G
Harold F. Greiner *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 113-122 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15096*# Mechanical Seal Technology, Albuquerque, NM.
THE APPLICATION OF DIFFERENTIAL ROUGHNESS TO MITIGATE FRICTION AND WEAR Abstract Only
Alan O. Lebeck *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 125 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15097*# Rockwell International Corp., Canoga Park, CA. Advanced Rotating Machinery Div.
SEAL TECHNOLOGY AT ROCKETDYNE
Joe Scharrer *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 127-122 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15098*# Aerojet-General Corp., Sacramento, CA.
CFD ACTIVITY AT AEROJET RELATED TO SEALS AND FLUID FILM BEARING
George E. Bache *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 133-138 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15099*# Pratt and Whitney Aircraft, West Palm Beach, FL.
PRATT AND WHITNEY ACTIVITIES
Saadat A. Syed *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 139-143 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15100*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
CFD APPLICATIONS IN PROPULSION
Charles L. Merkle *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 145-154 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15101*# Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
STATUS UPDATE ON THE SEAL/BEARING ROTORDYNAMICS TEST FACILITY AT CASE WESTERN RESERVE UNIVERSITY
Michael L. Adams *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 155-162 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15102*# Massachusetts Inst. of Tech., Cambridge.
SEAL TEST PROGRAM AT MIT Abstract Only
Manual Martinez-Sanchez and K. T. Millsaps, Jr. *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 163 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15103*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NATIONAL AEROSPACE PLANE ENGINE SEALS: HIGH TEMPERATURE SEAL PERFORMANCE EVALUATION
Bruce M. Steinetz *In its* Seals Flow Code Development Mar. 1991 p 165-170 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15105*# British Hydromechanics Research Association, Cranfield (England).
FLUID SEALS TECHNOLOGY AT BHR GROUP LTD. Abstract Only
Simon Leefe *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 173 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 11A

N92-15851*# Northrop Univ., Inglewood, CA. Dept. of Mechanical and Aeronautical Engineering.
HEAT SINK EFFECTS IN VARIABLE POLARITY PLASMA ARC WELDING
Amanie N. Abdelmessih *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 6 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 13H

N92-15854*# Jackson State Univ., MS. Dept. of Technology.
END-EFFECTOR FOR ROBOTIC ASSEMBLY OF WELDED TRUSS STRUCTURES IN SPACE
William V. Brewer *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 13I

N92-15882*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
LINEARIZED FORCE REPRESENTATIONS FOR TURBOPUMP LIQUID ANNULAR SEALS
Alan B. Palazzolo *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11A

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N92-15389# Allied-Signal Aerospace Co., Columbia, MD.
FAULT TYPE ENUMERATION AND CLASSIFICATION
M. M. Hugue 11 Nov. 1991 26 p
(Contract N00014-91-C-0014)
(AD-A242541) Avail: NTIS HC/MF A03 CSCL 12/5

The author defines a 'fault' as the identified or hypothesized cause of an error. An error is the manifestation of a fault, an undesired state either at the boundary or at an internal point in the system. A failure is the inability of the system or component to provide the specified service caused by an error. This report surveys of fault taxonomies used in classifying faults, and enumerates many commonly used fault types. Faults can be classified according to many attributes including cause, origin, persistence, duration, nature, extent, value, activity, symmetry and malice. After defining these and other fault attributes, we classify some fault types, and discuss the difficulties encountered in classifying many faults according to these taxonomies without sufficient knowledge of the characteristics of the environments, systems, and applications in which the faults arise. We enumerate and define faults in three classes: physical, environmental and operational faults. Finally, we present a total fault classification to be used within systems to define the classes of faults of interest and to specify the measures taken to tolerate those faults. GRA

N92-15390# Rome Air Development Center, Griffiss AFB, NY.
TOTAL QUALITY MANAGEMENT (TQM): AN OVERVIEW
Anthony Coppola Sep. 1991 48 p

(AD-A242594; RL-TR-91-305) Avail: NTIS HC/MF A03 CSCL 05/1

This report is essentially a slight modification of a tutorial paper prepared by the author for the 1992 Annual Reliability and Maintainability Symposium, providing a comprehensive overview of Total Quality Management (TQM). It discusses the reasons TQM is a current growth industry, what it is, and how one implements it. It describes the basic analytical tools, statistical process control, some advanced analytical tools, tools used by process improvement teams to enhance their own operations, and action plans for making improvements. The final sections discuss assessing quality efforts and measuring the quality to knowledge work. GRA

N92-15391# Naval Postgraduate School, Monterey, CA.
ARTIFICIAL NEURAL NETWORKS AND THEIR APPLICATIONS IN DIAGNOSTICS OF INCIPIENT FAULTS IN ROTATING MACHINERY M.S. Thesis
David K. Carlson Mar. 1991 209 p
(AD-A242712) Avail: NTIS HC/MF A10 CSCL 13/9

In an effort to curtail rising operating costs, machinery condition monitoring and diagnostics are being increasingly used as part of predictive maintenance programs. Vibration analysis is currently among the most effective tools in machinery condition monitoring and diagnostics but has proven difficult to automate fully. Artificial Neural Networks, patterned after neurological systems, provide a heuristic, data based approach to problems and have demonstrated robust behavior when faced with unique and noisy data. Thus neural networks may provide an alternative or complement to conventional rule based on expert systems in machinery diagnostics applications. Research is presented wherein a series of neural networks utilizing the highly successful back propagation paradigm are configured to provide machinery diagnostics for comparatively uncomplicated mechanical systems. Through observation of their presentation of genuine and artificially generated vibration data, an effort is made to ascertain their utility in more complicated systems. GRA

N92-15897*# University of Western Illinois, Macomb. Dept. of Mathematics.
RELIABILITY GROWTH MODELS FOR NASA APPLICATIONS
Vidya S. Taneja *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N92-15392# Sandia National Labs., Albuquerque, NM.
NUMERICAL SIMULATION OF VAWT STOCHASTIC AERODYNAMIC LOADS PRODUCED BY ATMOSPHERIC TURBULENCE: VAWT-SAL CODE
G. F. Homicz Sep. 1991 73 p
(Contract DE-AC04-76DP-00789)
(DE92-000597; SAND-91-1124) Avail: NTIS HC/MF A04

Blade fatigue life is an important element in determining the economic viability of the Vertical-Axis Wind Turbine (VAWT). A principal source of blade fatigue is thought to be the stochastic (i.e., random) aerodynamic loads created by atmospheric turbulence. This report describes the theoretical background of the VAWT Stochastic Aerodynamic Loads (VAWT-SAL) computer code, whose purpose is to numerically simulate these random loads, given the rotor geometry, operating conditions, and assumed turbulence properties. A Double-Multiple-Stream Tube (DMST) analysis is employed to model the rotor's aerodynamic response. The analysis includes the effects of Reynolds number variations, different airfoil sections and chord lengths along the blade span, and an empirical model for dynamic stall effects. The mean ambient wind is assumed to have a shear profile which is described by either a power law or a logarithmic variation with height above ground. Superimposed on this is a full 3-D field of turbulence: i.e., in addition to random fluctuations in time, the turbulence is allowed to vary randomly in planes perpendicular to the mean wind. The influence of flow retardation on the convection of turbulence through the turbine is also modeled. Calculations are presented for the VAWT 34-m Test Bed currently in operation at Bushland, Texas. Predicted time histories of the loads, as well as their Fourier spectra, are presented and discussed. Particular emphasis is placed on the differences between so-called 'steady-state' (mean wind only) predictions, and those produced with turbulence present. Somewhat surprisingly, turbulence is found to be capable of either increasing or decreasing the average output power, depending on the turbine's tip-speed ratio. A heuristic explanation for such behavior is postulated, and a simple formula is derived for predicting the magnitude of this effect without the need for a full stochastic simulation. DOE

N92-15393# Technical Research Centre of Finland, Espoo. Metals Lab.
THERMODYNAMICAL CONSIDERATIONS IN THE MATERIAL MODEL FOR CREEP PROPOSED BY LE GAC AND DUVAL
Kari Santaoja Mar. 1991 126 p Sponsored by Imatran Voima Oy
(VTT-RR-731; ISBN-951-38-3978-8; ISSN-0358-5077;
ETN-92-90675) Copyright Avail: NTIS HC/MF A07

Mathematical modeling of deformation of construction steels at elevated temperatures was investigated. Special attention was paid to the derivation of constitutive equations using irreversible thermodynamics. The creep equation proposed by Le Gac and Duval was studied from the thermodynamical point of view. Physical and mathematical modeling of creep processes were considered. The meaning of a 'correct set' of state variables was discussed. The consequences of the second law of thermodynamics found by studying 'constitutive processes' were also considered. The significant role of the 'constitutive processes' in the derivation of the Clausius-Duhem inequality was pointed out. Based on Ziegler's principle of maximal rate of entropy production, the specific dissipation function was shown to be a homogeneous function. The explicit forms of the specific Helmholz free energy and the specific dissipation function were set out. Using the above mentioned functions, the constitutive equation proposed by Le Gac and Duval was derived. The mutual dependence of the internal state variables was noticed and discussed. ESA

N92-15394# Technical Research Centre of Finland, Espoo. Ship Lab.
FEM AND FATIGUE LIFE CALCULATION USING THE PC-BASED NISA 2/ENDURE-SOFTWARE PACKAGE
Asko Kaehoenen May 1991 64 p Sponsored by Lappeenranta Univ. of Technology
(VTT-RR-735; ISBN-951-38-3983-4; ISSN-0358-5077;
ETN-92-90677) Copyright Avail: NTIS HC/MF A04

The fatigue life prediction capability of the NISA 2/ENDURE software package is studied. The software is used to calculate the fatigue life of three types of specimens, which were all previously fatigue tested in the laboratory. The properties of the NISA 2 finite element program and the fatigue analysis program ENDURE are given. ENDURE can be used for fatigue calculation with the Finite Element Method (FEM) stress results or as a stand alone program. The crack initiation calculation is based on the local strain approach, and crack propagation is predicted using mechanics. The crack initiation calculation was tested. By comparing the fatigue calculations with laboratory test results, it seems that the program gives satisfactory results. However, the number of these test runs is much too small to give a fully reliable comparison. The ENDURE results are to be seen as examples of the accuracy of the program. The use of fatigue integrated fatigue

analysis during the design process is going to shorten the product development time in the future. ESA

N92-15395# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
INSTRUMENTED BOLTS FOR MEASUREMENTS OF THEIR SHEAR LOAD TRANSFER IN SINGLE AND DOUBLE SHEAR JOINTS
Bjoern Palmberg Aug. 1991 89 p
(Contract FMV-FFL-82250-89-053-73-001)
(FFA-TN-1991-09; ETN-92-90722) Avail: NTIS HC/MF A05

Instrumented steel bolts with a diameter of 6.0 mm were manufactured and used in tension loaded, single, and double shear joints for determination of load transfer distributions. The bolts were calibrated such that the strain signals from the bolts could be correlated to shear load transfer in joints of different configurations. The performance of multi-row joints were studied for various combinations of sheet thicknesses and bolt installation torques. Some joint configurations were fatigue tested with instrumented bolts installed. It was found that the instrumented bolts are capable of determining the load transfer distributions in double and triple row joints. For triple row joints, it was found that the middle fastener row transfers a significantly smaller amount of the specimen load than the other two rows. For double shear joints with bolts installed using a torque of 4.0 Nm, the load transfer by friction is in the range of 32 to 45 percent of the applied specimen load. In single shear joints with torqued fasteners, the load transfer by friction amounted to 14 to 34 percent of the applied load. A gradual decrease of the bolt load transfer variation as the number of fatigue load cycles increased was observed. After relatively few load cycles, the bolt load variation was out of phase compared to the applied load. Furthermore, the bolt load variation was less than 18 percent of the applied load variation. ESA

N92-15396# Midwest Research Inst., Golden, CO.
PHOTOELASTIC STRESS ANALYSIS ON A PHOENIX 7.9-METER BLADE
W. D. Musial, M. D. Jenks, R. M. Osgood, and J. A. Johnson Oct. 1991 9 p Presented at the Seminar on Design and Construction of Storage and Disposal Facilities for Low-Level Radioactive Wastes, Troyes (France), 30 Sep. - 4 Oct. 1991
(Contract DE-AC02-83CH-10093)
(DE92-001156; NREL/TP-257-4512; CONF-910912-1) Avail: NTIS HC/MF A02

Photoelastic tests were conducted on the Phoenix 7.9-meter blade to develop the basic methodology for locating critical strain areas on full-scale composite structures. Under relatively low elastic loading, the strain fields over various regions on the blade planform were documented with 35 mm photographs under different loading conditions at the Solar Energy Research Institute (SERI) Structural Test Facility (STF). Strain concentrations were easily located and quantified. Principal strain magnitudes and directions were determined at the highest strain areas using separator gages. Results were compared to measured operating loads. This experiment demonstrated the value of experimental stress analysis using the photoelastic technique for the evaluation of composite blade designs. DOE

N92-15397# David Taylor Research Center, Bethesda, MD. Ship Materials Engineering Dept.
EFFECTS OF CYCLIC LOADING ON THE DEFORMATION AND ELASTIC-PLASTIC FRACTURE BEHAVIOR OF A CAST STAINLESS STEEL Research and Development Report
J. A. Joyce, E. M. Hackett, and C. Roe Oct. 1991 50 p
(AD-A242564; DTRC/SME-91-11) Avail: NTIS HC/MF A03 CSCL 11/6

Tests conducted in Japan as part of the High Level Vibration Test (HLVT) program for reactor piping systems revealed fatigue crack growth in a cast stainless steel pipe elbow. Material property data was developed to characterize cyclic deformation, cyclic elastic-plastic crack growth and ductile tearing resistance in the pipe elbow material. The tests conducted included monotonic and cyclic tensile tests, monotonic J-R curve tests, and cyclic elastic and elastic plastic fatigue crack growth rate tests. The cyclic elastic plastic fracture behavior of the stainless steel was the primary concern and was evaluated using a cyclic J-integral approach. It was found that the cast stainless steel was very resistant to ductile crack extension. J-resistance curves essentially followed a blunting behavior to very high J levels. High cycle fatigue crack growth rate data obtained on this stainless steel was typical of that reported in standard textbooks. Low cycle fatigue crack growth rate data obtained on this material using the cyclic J integral approach was consistent with the high cycle fatigue crack growth rate and with a standard textbook correlation equation typical for this type of material. Evaluation of crack closure effects was essential to accurately determine the crack driving force for cyclic elastic-plastic crack growth in this material. GRA

N92-15398# Texas Univ., Austin. Engineering Mechanics Research Lab.
BIFURCATION AND LOCALIZATION INSTABILITIES IN CYLINDRICAL SHELLS UNDER BENDING. PART 1: EXPERIMENTS
S. Kyriakides and G. T. Ju 1991 50 p
(Contract N00014-88-K-0610)
(AD-A242798; EMRL-90/9) Avail: NTIS HC/MF A03 CSCL 13/13

This study is concerned with the problem of bending of long, circular cylindrical shells. Of particular interest is the response of such shells, bent into the plastic range of the material, and the various instabilities which limit the extent to which the shells can be loaded or deformed. It is well known that bending of relatively thin-walled circular tubes induces ovalization to the tube cross section (Brazier effect (1927)). The growth of ovalization causes progressive reduction in the bending rigidity of the shell. Eventually, a maximum value of moment is reached. Further bending occurs at a dropping moment. For linearly elastic shells, when the maximum moment is reached the shell has undergone an ovalization which reduces the diameter of the cross section in the plane of bending by approximately 2/9ths. In practice, for thin shells, this limit load instability is often preceded by shell bifurcation-type instabilities characterized by circumferential and axial waves. In the case of thicker shells (D/t less than 100, say), the response, as well as the instabilities, are strongly influenced by interaction between the induced ovalization and the plastic characteristics of the material. GRA

N92-15399# Texas Univ., Austin. Engineering Mechanics Research Lab.
BIFURCATION AND LOCALIZATION INSTABILITIES IN CYLINDRICAL SHELLS UNDER BENDING. PART 2: PREDICTIONS
S. Kyriakides and G. T. Ju 1991 53 p
(Contract N00014-88-K-0610)
(AD-A242799; EMRL-90/10) Avail: NTIS HC/MF A04 CSCL 13/13

This study is concerned with the prediction of the response and various instabilities found to govern the elastic-plastic flexure of circular cylindrical shells. Sanders' shell kinematics and the principle of virtual work were used to formulate the problem. A Rayleigh-Ritz procedure was used to discretize the problem. The resultant nonlinear equations were solved iteratively using Newton's method. The three types of behavior involving bifurcation into short wavelength ripples, localization following the attainment of a natural limit load and interaction of the two were studied. In each case the predicted response was found to be in very good agreement with the experimental result. GRA

N92-15400*# Missouri Univ., Rolla. Dept. of Mechanical and Aerospace Engineering and Engineering Mechanics.
A SEMI-MICROMECHANIC INTERLAMINAR STRAIN ANALYSIS ON CURVED-BEAM SPECIMENS Final Report, Apr. - 31 Dec. 1990
Duksung Joh 31 Dec. 1990 30 p

(Contract NCC2-673)
(NASA-CR-189512; NAS 1.26:189512) Avail: NTIS HC/MF A03 CSCL 20K

Experimental analyses were performed for determination of interlaminar strains in circumferentially unidirectional curved beam specimens. Semi-circular and semi-elliptic carbon-epoxy specimens were subjected to opening mode tensile loadings. Whole field measurements were recorded at load levels from about 5 to more than 90 pct of failure loads. Contour maps of displacement fields were obtained by using moire interferometry, using reference gratings of 2400 lines/mm or 60,690 lines/in. Whole field contour maps of circumferential and interlaminar strains were obtained by using moire interferometry in a semi-micromechanic scale. Various anomalous effects were observed in the displacement fields. The zig-zag fringe patterns indicated that the fiber orientation in each layer was not truly circumferential. This deviation from the unidirectionality caused free-edge effects, such as interlaminar shear strains even at the axis of symmetry and the altered normal strains in the thickness direction. In the resin rich zones between layers, the tensile interlaminar strain was excessively large due to the large compliance. As the result of the combined effect of these anomalous behaviors, the values of the interlaminar tensile strains were larger than those predicted analytically. The modulus E sub 3 was actually smaller than the assumed value E sub 2 by 20 pct. Author

N92-15401*# Analytical Services and Materials, Inc., Hampton, VA.
ANALYSIS OF DELAMINATION IN CROSS PLY LAMINATES INITIATING FROM IMPACT INDUCED MATRIX CRACKING
S. A. Salpekar Nov. 1991 32 p
(Contracts NAS1-19399; NAS1-18599)
(NASA-CR-187594; NAS 1.26:187594) Avail: NTIS HC/MF A03 CSCL 20K

Several two dimensional finite element analyses of (0 sub 2/90 sub 8/0 sub 2) glass/epoxy and graphite-epoxy composite laminates were performed to study some of the characteristics of damage development due to an impact load. A cross section through the thickness of the laminate with fixed ends, and carrying a transverse load in the center was analyzed. Inclined matrix cracks such as those produced by low velocity impact were modeled in the 90 deg ply group. The introduction of the matrix cracks caused large interlaminar tension and shear stresses in the vicinity of both crack tips in the 0/90 and 90/0 interfaces. The large interlaminar stresses at the ends of the matrix cracks indicate that matrix cracking may give rise to delamination. The ratio of mode I to total strain energy release rate at the beginning of delamination calculated at the two matrix crack tips was 60 and 28 pct., respectively, in the glass/epoxy laminate. The corresponding ratio was 97 and 77 pct. in the graphite-epoxy laminate. Thus, a significant mode I component of strain energy release rate may be present at the delamination initiation due to an impact load. Author

N92-15402*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ANALYSIS OF AIRCRAFT ENGINE BLADE SUBJECT TO ICE IMPACT
E. S. Reddy, G. H. Abumeri (Sverdrup Technology, Inc., Brook Park, OH.), Christos C. Chamis, and P. L. N. Murthy 1991 24 p Presented at the Ninth Conference on Fibrous Composites in Structural Design, Lake Tahoe, NV, 4-7 Nov. 1991; cosponsored by DOD, NASA, and FAA
(NASA-TM-105336; E-6703; NAS 1.15:105336) Avail: NTIS HC/MF A03 CSCL 20K

The ice impact on the engine blade made of layered composite is simulated. The ice piece is modeled as an equivalent spherical object and has the velocity opposite to that of the aircraft with direction parallel to the engine axis. Near the impact region and along the leading edge, the blade is assumed to be fully stressed and undergoes large deflection. A specified portion of the blade around the impact region is modeled. The effect of ice size and velocity on the average leading edge strain are investigated for a modified SR-2 model unswept composite propfan blade. Parametric studies are performed to study the response due to ice impact at various locations along the span. Also, the effects of engine speed on the strain and impact displacements are discussed. It is found that for a given engine speed, a critical ice speed exists that corresponds to the maximum strain and this critical speed increases with increase in the engine speed. Author

N92-15403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PROBABILISTIC PROGRESSIVE BUCKLING OF TRUSSES
Shantaram S. Pai and Christos C. Chamis 1991 16 p Presented at the 32d Structures, Structural Dynamics, and Materials Conference, Baltimore, MD, 8-10 Apr. 1991; sponsored by AIAA, ASME, ASCE, AHS, and ASC
(NASA-TM-105162; E-6451; NAS 1.15:105162) Avail: NTIS HC/MF A03 CSCL 20K

A three-bay, space, cantilever truss is probabilistically evaluated to describe progressive buckling and truss collapse in view of the numerous uncertainties associated with the structural, material, and load variables (primitive variables) that describe the truss. Initially, the truss is deterministically analyzed for member forces, and member(s) in which the axial force exceeds the Euler buckling load are identified. These member(s) are then discretized with several intermediate nodes and a probabilistic buckling analysis is performed on the truss to obtain its probabilistic buckling loads and respective mode shapes. Furthermore, sensitivities associated with the uncertainties in the primitive variables are investigated, margin of safety values for the truss are determined, and truss end node displacements are noted. These steps are repeated by sequentially removing the buckled member(s) until onset of truss collapse is reached. Results show that this procedure yields an optimum truss configuration for a given loading and for a specified reliability. Author

N92-15404*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
THERMAL-STRUCTURAL PANEL BUCKLING TESTS
Randolph C. Thompson (PRC Kentron, Inc., Edwards, CA.) and W. Lance Richards Dec. 1991 22 p Presented at the 1991 Fall Conference on Structural Testing Technology at High Temperature, Dayton, OH, 4-6 Nov. 1991; sponsored by Society for Experimental Mechanics
(NASA-TM-104243; H-1778; NAS 1.15:104243) Avail: NTIS HC/MF A03 CSCL 20K

The buckling characteristics of a titanium matrix composite hat-stiffened panel were experimentally examined for various combinations of thermal and mechanical loads. Panel failure was prevented by maintaining the applied loads below real-time critical buckling predictions. The test techniques used to apply the loads, minimize boundary were shown to compare well with a finite-element buckling analysis for previous panels. Comparisons between test predictions and analysis for this panel are ongoing. Author

N92-15405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SPACE STATION FREEDOM SOLAR DYNAMIC MODULES STRUCTURAL MODELLING AND ANALYSIS
Charles Lawrence and Ron Morris (Sverdrup Technology, Inc., Brook Park, OH.) Dec. 1991 25 p
(NASA-TM-104506; E-6367; NAS 1.15:104506) Avail: NTIS HC/MF A03 CSCL 20K

In support of the Space Station Freedom (SSF) Solar Dynamic Power Module effort, structural design studies were performed to investigate issues related to the design of the power module, its pointing capabilities, and the integration of the module into the SSF infrastructure. Of particular concern from a structural viewpoint are the dynamics of the power module, the impact of the power module on the Space Station dynamics and controls, and the required control effort for obtaining the specified Solar Dynamic Power Module pointing accuracy. Structural analyses were performed to determine the structural dynamics attributes of both

the existing and the proposed structural dynamics module designs. The objectives of these analyses were to generate validated Solar Dynamic Power Module NASTRAN finite element models, combine Space Station and power module models into integrated system models, perform finite element modal analyses to assess the effect of the relocations of the power module center of mass, and provide modal data to controls designers for control systems design.
Author

N92-15406*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
STRUCTURAL DYNAMICS BRANCH RESEARCH AND ACCOMPLISHMENTS FOR FY 1990
Nov. 1991 43 p
(NASA-TM-103747; E-5993; NAS 1.15:103747) Avail: NTIS HC/MF A03 CSCL 20K

Presented here is a collection of FY 1990 research highlights from the Structural Dynamics Branch at the NASA Lewis Research Center. Highlights are from the branch's major work areas: aeroelasticity, vibration control, dynamic systems, and computational structural methods. A listing is given of FY 1990 branch publications.
Author

N92-15862*# Alabama Univ., Tuscaloosa. Dept. of Engineering Mechanics.
USE OF PHOTOSTRESS TECHNIQUES TO CHARACTERIZE THE MECHANICAL BEHAVIOR OF WELDMENTS
Samuel C. Gambrell, Jr. *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20K

N92-15887*# Alabama Univ., Tuscaloosa. Dept. of Engineering.
USING PROBABILISTIC ANALYSIS TO ASSESS THE RELIABILITY OF PREDICTED SRB AFT-SKIRT STRESSES
James A. Richardson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N92-15407# Institute of Oceanographic Sciences, Wormley (England). Deacon Lab.
EUROPEAN MARINE ATLASES: CURRENT TRENDS AND FUTURE DIRECTIONS
G. J. Robinson, ed. and D. T. Pugh, ed. 1991 69 p Workshop held in Reading, England, Apr. 1990
(IOS-283; ETN-92-90324) Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The proceedings of a workshop aimed at bringing together European marine scientists and other specialists to discuss ways of presenting the increasing volumes of information available to marine scientists, particularly through establishment of a European Marine atlas, are discussed. The financial, administrative and technical issues involved in such a program are outlined. For individual titles, see N92-15408 through N92-15417.

N92-15408# United Nations Environment Programme, Athens (Greece). Co-Ordinating Unit for the Mediterranean Action Plan.
UNEP/MAP: ON-MAP PRESENTATION ACTIVITIES
Adnan Aksel *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 13-19 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The Mediterranean Action Plan (MAP) is described. The geographical coverage of MAP is the Mediterranean between the straits of Gibraltar and the straits of the Dardanelles. The role of the coordinating Unit for the Mediteranean Action Plan (MEDU) is described. MEDU monitors the following MAP components: regional marine pollution emergency response center for the Mediterranean Sea: priority actions program; blue plan; and the specially protected areas. Map data processing, map data inventories and on map presentation activities are described. Features involved in the preparation of a European digital marine atlas are discussed.
ESA

N92-15409# Institute of Marine Research, Bergen (Norway).
PRESENTATION OF MARINE INFORMATION ON MAPS AT THE INSTITUTE OF MARINE RESEARCH
Per Tjora *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 21-26 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The ITAKS system, used in the presentation of marine information at the Institute of Marine Research (IMR), is described. The ITAKS system is composed of three main sections: the MAP (Mediterranean Action Plan) database, the MAP LIBRARY based on the GPGS-F graphical library, and the FOCUS screen handling system from NORSK DATA as the user interface. Each of these sections is described. The ARC/INFO Geographical Information System (GIS) is evaluated. The possibility of using a third party software tool in addition to ITAKS is discussed.
ESA

N92-15410# Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
CERBOM: STONE-AGE METHODS, ALL BY HAND
Pierre Revillon *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 27-39 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The traditional data processing methods used to analyze the spatial distribution of oceanographic parameters such as salinity, temperature, concentrations of heavy metals or other chemical or biological constituents in a certain area, are described. The advantages and disadvantages of this traditional approach in drawing isopleths are discussed. An example of a computerized method in a neigboring field is considered. Automatic triangulation of station points from which the computer can draw isopleths through the patchwork of triangles is considered. It is shown that occasionally, ambiguous situations arise in which case manual intervention is necessary.
ESA

N92-15411# Geological Survey of Portugal, Lisbon. Nucleo de Geologia Marinha.
DIGITAL CATALOGUE OF GEOLOGICAL OCEANOGRAPHY DATA AT THE PORTUGUESE GEOLOGICAL SURVEY
Jose Monteiro *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 41-42 (For primary document see N92-15407 06-43)

Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The history of the development of Marine Geology Data Catalogs at the Portugese Geological Survey is described. The use of small microcomputer systems equipped with plotting and digitizing facilities as reasonably priced tools for automated cartography and in producing maps and illustrations for geological reporting is discussed. An official scale system for producing geological maps of the continental shelf and for drafting sections and other illustrations is described. ESA

N92-15412# Ministry of Public Health and Environment, Brussels (Belgium). Management Unit of the Mathematical Model of the North Sea.

MUMM'S ACTIVITIES AND SPECIAL INTEREST IN DIGITIZED GEOGRAPHICAL INFORMATION

Jean-Paul Mommaerts *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 43-50 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The responsibilities of the Management Unit of the Mathematical Model of the North Sea (MUMM) are outlined. Responsibilities in the areas of marine environmental protection and resource assessment are described. They include the monitoring of the North Sea environment, the study of marine processes, marine resource management, marine pollution using mathematical modeling, and the management of state environmental protection activities relating to the sea. The mathematical models used are discussed and evaluated. ESA

N92-15413# La Tene Maps Ltd., Sandyford (Ireland).

THE IRISH SITUATION

John Coleman *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 51-53 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

A computer based Geographical Information System (GIS) and digital atlas systems for data management and retrieval are discussed. Possible applications of such systems in the development of a national marine database by the Marine Institute of Ireland are discussed. The system chosen needs to be flexible and able to network with databases both in Ireland and in the wider community. A system able to provide ROM (Read Only Memory) discs for the distribution of information and educational material is discussed. ESA

N92-15414# Geological Survey, Reston, VA. Joint USGS-NOAA Office for Mapping and Research in the EEZ.

EAST COAST GLORIA DATA ON CD-ROMS

Millington Lockwood *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 55-56 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The Geological Long Range Inclined Asdic (GLORIA) reconnaissance scale mapping tool selected to map the Exclusive Economic Zone (EEZ) is described. GLORIA maps the ocean floor using a side scan sonar method. The images of the sea floor are produced by transmitting sound pulses from two sets of tranducers in the towed vehicle which look to port and starboard, respectively. Each transmitted signal insonifies a narrow band of sea floor from directly below the towed vehicle out to the side a distance of approximately 22 km. This data is then presented on CD-ROM (Compact Disc-Read Only Memory) discs. A list of CD-ROM discs already made of the ocean floor off the United State's coast is presented. ESA

N92-15415# Instituto Espanol de Oceanografia, Madrid (Spain). Services Centrales, Geologica Marina.

COMPUTER PRESENTATION OF INFORMATION AT INSTITUTO ESPANOL DE OCEANOGRAFIA

Jose Sanz *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 57-58 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

A national atlas of Spain assembled by the Instituto Geografico Nacional (IGN) is described. The atlas is to be offered in traditional (paper) and digital formats. The role of the Instituto Espanol de Oceanografia (IEO) in coordinating the activities of marine science participants in the development of the atlas is described. Thematic maps of bathymetry, coastal characteristics, sediments in marine basins, surface currents, temperature, salinity, and waves (height and frequency), are described. ESA

N92-15416# Athens Univ. (Greece). Dept. of Submarine Geology.

SUBMARINE GEOLOGICAL ACTIVITIES OF THE INSTITUTE OF GEOLOGICAL AND MINING EXPLORATION

Andreas Andrinopoulos *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 59-62 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

The targets of the Institute of Geological and Mining Exploration (IGME) are described. These include the study of the sea floor and underlying geology, the detection of sedimentary mineral concentrations (placers), the construction of sea floor maps and undertaking work for third parties. The field work, laboratory analysis, maps, data banks, computerized analysis, and software involved in these activities are described. The production of digital maps constructed from real data files is discussed. ESA

N92-15417# Osservatorio Geofisico Sperimentale, Trieste (Italy).

MARINE DATA MANAGEMENT AT OSSERVATORIO GEOFISICO SPERIMENTALE **c82**

Beniamino Manca *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 63-69 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

A data management system developed to hold and process large data sets of current meter data, wave data, hydrographic station data and CTD data, is described. Development of a data bank in the framework of the Italian-Yugoslav monitoring program for the protection of the Adriatic sea, is discussed. System design for the data bank is studied. Data acquisition, screening, storage structures and exchange techniques are evaluated. Generation of a thematic map, or more generally, of a scientific visualization of marine data, is discussed. ESA

N92-15418# Beleidscommissie Remote Sensing, Delft (Netherlands).

AGRISCATT: QUALITY ANALYSIS, DATA DESCRIPTION AND STATISTICAL ANALYSIS OF THE DUTSCAT 1988 DATA

B. A. M. Bouman, M. A. M. Vissers, and D. Uenk (Centre for Agrobiological Research, Wageningen, Netherlands) Jul. 1991 113 p
(BCRS-90-35; ETN-92-90435) Copyright Avail: NTIS HC/MF A06

The radar backscatter behavior of agricultural crops was investigated in different frequency bands (1.2 to 17.3 GHz), and preliminary conclusions were drawn on the use of multifrequency radar observations for classification and growth monitoring of sugar beet, potato and winter wheat. The radar data were collected during the Agriscatt 1988 campaign over the Dutch test site with

the Delft University of Technology Scatterometer (DUSCAT). Data interpretation was preceded by a quality analysis of the radar data. ESA

N92-15419# Beleidscommissie Remote Sensing, Delft (Netherlands).
APPLICABILITY OF REMOTE SENSING FOR DISASTER MITIGATION: EVALUATION
E. J. A. Lohman, T. M. Wolters, and C. Voute (Eurosense B.V., The Hague, Netherlands) Jun. 1991 20 p
(BCRS-91-11; ETN-92-90441) Avail: NTIS HC/MF A03

The operational applicability of remote sensing and image processing techniques, on short, medium and long term, for the prevention and mitigation of the effects from natural disasters is considered. The project is focused on human settlements in developing countries. Disaster mitigation refers to those actions taken, within the given socioeconomic, physical and technical situation, to reduce the risk of life and property and disruption from a natural or manmade hazard, by reducing the vulnerability, modifying the hazard or changing the function of land or constructions. Remote sensing has made a significant contribution to these, notably in areas such as integrating land use maps with hazard maps. The constraints related to the operational applicability of remote sensing are at the social, economic and political level and not only in the technique. Criteria for operational applicability of remote sensing for disaster mitigation planning, in order to improve the dialogue between the mitigation planning team and the remote sensing specialist are provided. ESA

N92-15420# Beleidscommissie Remote Sensing, Delft (Netherlands).
MODELLING AND SYNERGETIC USE OF OPTICAL AND MICROWAVE REMOTE SENSING. REPORT 3: MULTITEMPORAL ANALYSIS OF OPTICAL SATELLITE DATA BACKGROUND (SOIL) CORRECTION, RADIOMETRIC CORRECTION AND GEOREFERENCINGNG
J. G. P. W. Clevers and H. J. Buiten (Wageningen Agricultural Univ., Netherlands) Jul. 1991 70 p
(BCRS-91-02; ETN-92-90442) Avail: NTIS HC/MF A04

The application of the Weighted (near infrared to red) Difference Vegetation Index (WDVI) to satellite data is evaluated. The WDVI offered a good correction for soil background (soil moisture) in estimating the Leaf Area Index (LAI) of e.g. cereals. With satellites, digital numbers instead of reflectance factors are obtained. As a result, in a multitemporal analysis of optical satellite data for parameter estimation radiometric correction is essential. Radiometric errors can result from the instrumentation used to record the data and from the effect of the atmosphere. An empirical procedure for applying the WDVI to satellite data is described: offset correction, calculating the slope of the soil line, and calculating the WDVI for satellite data. Application of the WDVI concept induces a considerable simplification of data analysis. Since atmospheric correction is indispensable for a multitemporal analysis of optical satellite data, the above procedure is extended in order to derive the WDVI in a multitemporal analysis based on surface information only (e.g., water, bare soil and urban areas). A geometric correction of LANDSAT Thematic Mapper data for georeferencing by using a trend model yielded very satisfactory results with respect to precision and reliability. ESA

N92-15421# Environmental Research Inst. of Michigan, Ann Arbor.
SSM/I SEA ICE PRODUCTS VALIDATION Final Report, Jul. 1988 - Sep. 1990
R. Jentz, C. Wackerman, and R. Shuchman Jun. 1991 82 p
(Contract N00014-88-C-0680)
(AD-A242491; ERIM-212800-4-F) Avail: NTIS HC/MF A05 CSCL 08/12

The Special Sensor Microwave/Imager (SSM/I), which is part of the Defense Meteorological Satellite Program (DMSP), is a coarse resolution passive microwave sensor with good aerial coverage of the Arctic region. Since the SSM/I sensor produces nearly full coverage of the Arctic region each day, data generated by this sensor is used to obtain geophysical parameters associated with the Arctic area. An algorithm has been developed at Goddard Space Flight Center which produces both multiyear and total ice concentration estimates from SSM/I data. This paper presents comparisons between these SSM/I derived ice concentration estimates and estimates derived from high resolution SAR data that was collected coincidently with the SSM/I overpass. Data from the Beaufort and Bering Seas collected in March of 1988 is used and both the multilayer concentration algorithm and the total ice concentration algorithm are compared. A discrepancy between the two estimates is analyzed and a possible explanation based on the scattering from ridging in first-year ice is presented. GRA

N92-15422# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ACTIVE AND PASSIVE REMOTE SENSING OF ICE Annual Report, 1 Oct. 1990 - 30 Sep. 1991
J. A. Kong 15 Nov. 1991 160 p
(Contract N00014-89-J-1107)
(AD-A242648) Avail: NTIS HC/MF A08 CSCL 08/12

Fully polarimetric scattering of electromagnetic waves from snow and ice is studied with a multi-layered random medium model and applied to interpret experimental data obtained under laboratory controlled conditions such as CRRELEX. The snow layer is modeled as an isotropic random medium. The sea ice is described as an anisotropic random medium due to the nonspherical shape of brine inclusions. The underlying sea water is considered as a homogeneous half-space. The random media in both layers are characterized by three-dimensional correlation functions with variances and correlation lengths corresponding to the fluctuation strengths and the physical geometries of the inhomogeneities, respectively. The strong fluctuation theory is used to calculate the effective permittivities of the random media. The distorted Born approximation is then employed to obtain the covariance matrix which represents the fully polarimetric scattering properties of the snow-ice media. It has been shown that the polarimetric covariance matrix contains more information than the conventional scattering coefficients on the remotely sensed media. GRA

N92-15468*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MICROWAVE SENSING TECHNOLOGY ISSUES RELATED TO A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
Thomas G. Campbell, Jim Shiue, Denis Connolly, and Ken Woo (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 181-186 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 13B

N92-15476*# Joint Inst. for Advancement of Flight Sciences, Hampton, VA.
PLOTS OF GROUND COVERAGE ACHIEVEABLE BY GLOBAL CHANGE MONITORING INSTRUMENTS AND SPACECRAFT
Heather R. Knight and Lynda Foernsler (Auburn Univ., AL.) *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study Sep. 1991 p 381-411 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 08B

N92-15875*# Puerto Rico Univ., Rio Piedras. Dept. of Civil Engineering.
EFFECTS OF VEGETATION ON SOIL MOISTURE DISTRIBUTION AND FLUX WITH IMPLICATIONS FOR THE GLOBAL HYDROLOGIC CYCLE
Emir Jose Macari *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 08H

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N92-15423# New Energy Development Organization, Tokyo (Japan).
SURVEY CONCERNING HYDROGEN SUPPLING SYSTEM FOR PHOSPHORIC ACID FUEL CELLS, PART 2
Mar. 1989 99 p In JAPANESE; ENGLISH summary
(DE90-503593; NEDO-P-8810-Pt-2) Avail: NTIS (US Sales Only) HC/MF A05

Most phosphoric acid fuel cells have excellent features on load variation and lower load characteristics. In order to exhibit these features further, it is necessary to reasonably improve the hydrogen supplying system and a powerful measure is to apply the thermally effective conversion technology (TECT) using a permeable solid to a reformer. Subsequent to the fundamental survey carried out in 1988, the conceptual design of the reformer applying this idea was carried out this year to make static and dynamic analyses and address problems which occur in practical use. Dynamic simulation for the reformer applying TECT showed excellent loading response and agreed well with the previous fundamental experiments. In addition, the conceptual design of a fuel cell power generating system by using this TECT applied reformer was made and a comparatively compact unit became possible. DOE

N92-15424# Sandia National Labs., Albuquerque, NM.
THE EFFECTS OF CONCENTRATED ULTRAVIOLET LIGHT ON HIGH-EFFICIENCY SILICON SOLAR CELLS
D. S. Ruby and W. K. Schubert 1991 8 p Presented at the 22nd IEEE Photovoltaic Specialists Conference, Las Vegas, NV, 7-11 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-000980; SAND-91-0433C; CONF-911055-2) Avail: NTIS HC/MF A02

The importance of stability in the performance of solar cells is clearly recognized as fundamental. Some of the highest efficiency silicon solar cells demonstrated to date, such as the Point Contact solar cell and the Passivated Emitter solar cell, rely upon the passivation of cell surfaces in order to minimize recombination, which reduces cell power output. Recently, it has been shown that exposure to ultraviolet (UV) light of wavelengths present in the terrestrial solar spectrum can damage a passivating silicon-oxide interface and increase recombination. In this study, we compared the performance of Point Contact and Passivated Emitter solar cells after exposure to UV light. We also examined the effect of UV exposure on oxide-passivated silicon wafers. We found that current Passivated Emitter designs are stable at both one-sun and under concentrated sunlight. The evolution of Point Contact concentrator cell performance shows a clear trend towards more stable cells. DOE

N92-15425# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
A SCHEME OF PARAMETRIC ENERGY TRANSFORMATION
I. L. Verbitskij, A. D. Kovalenko, and V. G. Kolesnik (Tashkent V. I. Lenin State Univ., Vuzgorodok, USSR) 1990 9 p In RUSSIAN; ENGLISH summary
(DE91-639012; JINR-R-9-90-371) Avail: NTIS HC/MF A02

An energy transformation scheme is considered based on a parametric interaction of charged particle bunches with a self high frequency electromagnetic field generated in a resonant cavity which is also supplied by an external electrostatic field. DOE

N92-15426# International Centre for Theoretical Physics, Trieste (Italy).
EFFECT OF OXYGEN AND CARBON IMPURITIES ON THE PERFORMANCE OF SILICON SINGLE CRYSTAL SOLAR CELLS
P. Akhter, M. N. Zakir, A. Baig, Z. I. Ziadi, M. Ahmad, S. Hussain, I. A. Qazi, and A. Mufti Sep. 1990 9 p
(DE91-625261; IC-90/294) Avail: NTIS HC/MF A02

BSF solar cells are fabricated using B-doped wafers cut from Czochralski Si(100) single crystals. The effect of unintentional impurities of oxygen and carbon atoms on solar cell performance parameters have been studied. The presence of carbon atoms shows an improvement in all parameters particularly the short circuit current where oxygen shows an adverse effect. DOE

N92-15427# Sandia National Labs., Albuquerque, NM.
STRUCTURAL ANALYSIS OF A REFLUX POOL-BOILER SOLAR RECEIVER
E. L. Hoffman and C. M. Stone Jun. 1991 52 p
(Contract DE-AC04-76DP-00789)
(DE92-002211; SAND-91-0862) Avail: NTIS HC/MF A04

Coupled thermal-structural finite element calculations of a reflux pool-boiler solar receiver were performed to characterize the operating stresses and to address issues affecting the service life of the receiver. Analyses performed using shell elements provided information for receiver material selection and design optimization. Calculations based on linear elastic fracture mechanics principles were performed using continuum elements to assess the vulnerability of a seam-weld to fatigue crack growth. All calculations were performed using ABAQUS, a general purpose finite element code, and elements specifically formulated for coupled thermal-structural analysis. Two materials were evaluated: 316L SS and Haynes 230 alloys. The receiver response was simulated for a combination of structural and thermal loads that represent the startup and operating conditions of the receiver. For both materials, maximum stresses in the receiver developed shortly after startup due to uneven temperature distribution across the receiver surface. The largest effective stress was near yield in the 316L SS receiver and below 39 percent of yield in the Haynes 230 receiver. The calculations demonstrated that stress reductions of over 25 percent could be obtained by reducing the aft dome thickness to one closer to the absorber. The fatigue calculations demonstrated that the stress distribution near the seam-weld notch depends primarily on the structural load created by internal pressurization of the receiver rather than the thermal, indicating that the thermal loads can be neglected when assessing the stress intensity near the seam-weld notch. The stress intensity factor, computed using the J-integral method and crack opening-displacement field equations, was significantly below the fatigue threshold for most steels. The calculations indicated that the weld notch was always loaded in compression, a condition which is not conducive to fatigue crack growth. DOE

N92-15428*# University of South Florida, Tampa.
EVALUATION OF IN-SITU THERMAL ENERGY STORAGE FOR LUNAR BASED SOLAR DYNAMIC SYSTEMS Final Report
Roger A. Crane Mar. 1991 47 p
(Grant NAG3-851)
(NASA-CR-189054; NAS 1.26:189054) Avail: NTIS HC/MF A03 CSCL 10B

A practical lunar based thermal energy storage system, based on locally available materials, could significantly reduce transportation requirements and associated costs of a continuous, solar derived power system. The concept reported here is based on a unique, in-situ approach to thermal energy storage. The proposed design is examined to assess the problems of start-up and the requirements for attainment of stable operation. The design remains, at this stage, partially conceptional in nature, but certain aspects of the design, bearing directly on feasibility, are examined in some detail. Specifically included is an engineering evaluation of the projected thermal performance of this system. Both steady state and start-up power requirements are evaluated and the

associated thermal losses are evaluated as a basis for establishing potential system performance. Author

N92-15429# Sandia National Labs., Albuquerque, NM.
EXPERT SYSTEMS TO AID IN WIND FARM OPERATIONS
L. L. Schluter, F. Nateghian, and G. F. Luger (New Mexico Univ., Albuquerque.) 1991 9 p Presented at the American Society of Mechanical Engineers (ASME) Energy Sources Technology Conference and Exhibition, Houston, TX, 26-30 Jan. 1992
(Contract DE-AC04-76DP-00789)
(DE92-000791; SAND-91-1436C; CONF-920122-3) Avail: NTIS HC/MF A02

An expert system is a knowledge-based program that provides solutions to problems in a specific domain by mimicking the behavior of a human expert. Expert systems can have several advantages over traditional programming methods; however, developing an expert system generally involves a considerable amount of time and money. Therefore, careful investigation must be done to ensure that a problem is suited for an expert system application. This paper examines several areas where an expert system may help wind farm operators lower their operational costs. Justifications for using expert systems rather than traditional programming methods are given. This paper also discusses some of the design decisions that were made in developing an expert system for US Windpower that will aid in diagnosing wind turbine failures. DOE

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N92-15430*# National Aeronautics and Space Administration, Washington, DC.
SCIENTIFIC ASSESSMENT OF STRATOSPHERIC OZONE: 1989, VOLUME 1
1990 494 p Prepared in cooperation with Department of the Environment, London, England; NOAA, Washington, DC; UN Environment Programme, Nairobi, Kenya; and WMO, Geneva, Switzerland Original contains color illustrations
(NASA-TM-105442; NAS 1.15:105442; GORMP-20-Vol-1; ISBN-92-807-1255-1) Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland; 5 functional color pages CSCL 13B

A scientific review is presented of the current understanding of stratospheric ozone. There have been highly significant advances in the understanding of the impact of human activities on the Earth's protective ozone layer. There are four major findings that each heighten the concern that chlorine and bromine containing chemicals can lead to a significant depletion of stratospheric ozone: (1) Antarctic ozone hole (the weight of evidence indicates that chlorinated and brominated chemicals are responsible for the ozone hole; (2) Perturbed arctic chemistry (the same potentially ozone destroying processes were identified in the Arctic stratosphere); (3) Long term ozone decreases; and (4) Model limitations (gaps in theoretical models used for assessment studies). For individual titles, see N92-15431 through N92-15434.

N92-15431*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
POLAR OZONE
S. Solomon, W. L. Grose, R. L. Jones, M. P. McCormick, Mario J. Molina, A. ONeill, L. R. Poole, K. P. Shine, R. A. Plumb, and V. Pope (Meteorological Office, Bracknell, England) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 1 1990 p 1-161 (For primary document see N92-15430 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland; 5 functional color pages CSCL 13B

The observation and interpretation of a large, unexpected ozone depletion over Antarctica has changed the international scientific view of stratospheric chemistry. The observations which show the veracity, seasonal nature, and vertical structure of the Antarctic ozone hole are presented. Evidence for Arctic and midlatitude ozone loss is also discussed. The chemical theory for Antarctic ozone depletion centers around the occurrence of polar stratospheric clouds (PSCs) in Antarctic winter and spring; the climatology and radiative properties of these clouds are presented. Lab studies of the physical properties of PSCs and the chemical processes that subsequently influence ozone depletion are discussed. Observations and interpretation of the chemical composition of the Antarctic stratosphere are described. It is shown that the observed, greatly enhanced abundances of chlorine monoxide in the lower stratosphere are sufficient to explain much if not all of the ozone decrease. The dynamic meteorology of both polar regions is given, interannual and interhemispheric variations in dynamical processes are outlined, and their likely roles in ozone loss are discussed. Author

N92-15432*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL TRENDS
G. Megie, M.-L. Chanin, D. Ehhalt, P. Fraser, J. F. Frederick, J. C. Gille, M. P. McCormick, M. Schoebert, L. Bishop, and R. D. Bojkov (World Meteorological Organization, Geneva, Switzerland) et al *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 1 1990 p 163-281 (For primary document see N92-15430 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland; 5 functional color pages CSCL 13B

Measuring trends in ozone, and most other geophysical variables, requires that a small systematic change with time be determined from signals that have large periodic and aperiodic variations. Their time scales range from the day-to-day changes due to atmospheric motions through seasonal and annual variations to 11 year cycles resulting from changes in the sun UV output. Because of the magnitude of all of these variations is not well known and highly variable, it is necessary to measure over more than one period of the variations to remove their effects. This means that at least 2 or more times the 11 year sunspot cycle. Thus, the first requirement is for a long term data record. The second related requirement is that the record be consistent. A third requirement is for reasonable global sampling, to ensure that the effects are representative of the entire Earth. The various observational methods relevant to trend detection are reviewed to characterize their quality and time and space coverage. Available data are then examined for long term trends or recent changes in ozone total content and vertical distribution, as well as related parameters such as stratospheric temperature, source gases and aerosols. Author

N92-15433*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THEORETICAL PREDICTIONS
G. Brasseur, B. A. Boville, C. Bruhl, M. Caldwell, Peter S. Connell, A. DeRudder, A. Douglas, I. Dyominov, D. Fisher, and J. F. Frederick (Chicago Univ., IL.) et al *In* NASA, Scientific Assessment of Stratospheric Ozone: 1989, Volume 1 1990 p 283-399 (For primary document see N92-15430 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland; 5 functional color pages CSCL 13B

In order to understand the impact of man made chemicals on the atmospheric ozone layer, it is essential to develop models that can perform long term predictions of future ozone changes. An advantage of using two dimensional models is that they can be used to predict latitudinal and seasonal changes in ozone. The formulation and recent improvements are described in 2-D models, which are used herein, along with the three dimensional models that are currently being developed to better simulate transport of chemically active trace gases, especially in polar regions. The range in 2-D model calculations is described. Selected fields calculated by these models are compared with observations. A number of scenarios have been defined, which encompass possible emission rates of different halocarbons. Because of the large uncertainties in the rates for heterogeneous processes, the

calculated responses of the models include only the effects of homogeneous chemistry. One important distinction among the models is their ability to account for temperature feedbacks on the calculated ozone changes. Author

N92-15434*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
HALOCARBON OZONE DEPLETION AND GLOBAL WARMING POTENTIALS
Richard A. Cox, D. Wuebbles, R. Atkinson, Peter S. Connell, H. P. Dorn, A. DeRudder, Richard G. Derwent, F. C. Fehsenfeld, D. Fisher, and Ivar S. A. Isaksen (Oslo Univ., Norway) et al *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 1 1990 p 401-466 (For primary document see N92-15430 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland; 5 functional color pages CSCL 13B

Concern over the global environmental consequences of fully halogenated chlorofluorocarbons (CFCs) has created a need to determine the potential impacts of other halogenated organic compounds on stratospheric ozone and climate. The CFCs, which do not contain an H atom, are not oxidized or photolyzed in the troposphere. These compounds are transported into the stratosphere where they decompose and can lead to chlorine catalyzed ozone depletion. The hydrochlorofluorocarbons (HCFCs or HFCs), in particular those proposed as substitutes for CFCs, contain at least one hydrogen atom in the molecule, which confers on these compounds a much greater sensitivity toward oxidation by hydroxyl radicals in the troposphere, resulting in much shorter atmospheric lifetimes than CFCs, and consequently lower potential for depleting ozone. The available information is reviewed which relates to the lifetime of these compounds (HCFCs and HFCs) in the troposphere, and up-to-date assessments are reported of the potential relative effects of CFCs, HCFCs, HFCs, and halons on stratospheric ozone and global climate (through 'greenhouse' global warming). Author

N92-15435*# National Aeronautics and Space Administration, Washington, DC.
SCIENTIFIC ASSESSMENT OF STRATOSPHERIC OZONE: 1989, VOLUME 2. APPENDIX: AFEAS REPORT
1990 478 p Prepared in cooperation with Department of the Environment, London, England; NOAA, Washington, DC; UN Environment Programme, Nairobi, Kenya; and WMO, Geneva, Switzerland
(NASA-TM-105443; NAS 1.15:105443; GORMP-20-Vol-2) Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

The results are presented of the Alternative Fluorocarbon Environmental Acceptability Study (AFEAS), which was organized to evaluate the potential effects on the environment of alternate compounds targeted to replace fully halogenated chlorofluorocarbons (CFCs). All relevant current scientific information to determine the environmental acceptability of the alternative fluorocarbons. Special emphasis was placed on: the potential of the compounds to affect stratospheric ozone; their potential to affect tropospheric ozone; their potential to contribute to model calculated global warming; the atmospheric degradation mechanisms of the compounds, in order to identify their products; and the potential environmental effects of the decomposition products. The alternative compounds to be studied were hydrofluorocarbons (HFCs) with one or two carbon atoms and one or more each of fluorine and hydrogen. For individual titles, see N92-15436 through N92-15451.

N92-15436*# National Inst. of Standards and Technology, Boulder, CO. Thermophysics Div.
PHYSICAL PROPERTIES OF ALTERNATIVES TO THE FULLY HALOGENATED CHLOROFLUOROCARBONS
Mark O. McLinden *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 9-38 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Presented here are recommended values and correlations of selected physical properties of several alternatives to the fully halogenated chlorocarbons. The quality of the data used in this compilation varies widely, ranging from well-documented, high accuracy measurements from published sources to completely undocumented values listed on anonymous data sheets. That some of the properties for some fluids are available only from the latter type of source is clearly not the desired state of affairs. While some would reject all such data, the compilation given here is presented in the spirit of laying out the present state of knowledge and making available a set of data in a timely manner, even though its quality is sometimes uncertain. The correlations presented here are certain to change quickly as additional information becomes available. Author

N92-15437*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVALUATED RATE CONSTANTS FOR SELECTED HCFC'S AND HFC'S WITH OH AND O((SUP)1D)
Robert F. Hampson, Michael J. Kurylo (National Inst. of Standards and Technology, Gaithersburg, MD.), and Stanley P. Sander *In* NASA, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 43-104 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

The chemistry of HCFC's and HFC's in the troposphere is controlled by reactions with OH in which a hydrogen atom is abstracted from the halocarbon to form water and a halo-alkyl radical. The halo-alkyl radical subsequently reacts with molecular oxygen to form a peroxy radical. The reactions of HCFC's and HFC's with O(exp1D) atoms are unimportant in the troposphere, but may be important in producing active chlorine of OH in the stratosphere. Here, the rate constants for the reactions of OH and O(exp1D) with many HFC's and HCFC's are evaluated. Recommendations are given for the five HCFC's and three HFC's specified by AFEAS as primary alternatives as well as for all other isomers of C1 and C2 HCFC's and HFC's where rate data exist. In addition, recommendations are included for CH3CCl3, CH2Cl2, and CH4. Author

N92-15438*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REVIEW OF ULTRAVIOLET ABSORPTION CROSS SECTIONS OF A SERIES OF ALTERNATIVE FLUOROCARBONS
Mario J. Molina *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 109-119 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Solar photolysis is likely to contribute to the stratospheric destruction of those alternative fluorocarbons (HFC's) which have two or more chlorine atoms bonded to the same carbon atom. Two of the eight HFC's considered here fall into this category, namely HFC-123 and HFC141b. For these two species there is good agreement among the various measurements of the ultraviolet cross sections in the wavelength region which is important for atmospheric photodissociation, that is, around 200 nm. There is also good agreement for HFC-124, HFC-22 and HFC-142b. These are the three species which contain one chlorine atom per molecule. The agreement in the measurements is poor for the other species, i.e., those that do not contain chlorine, except in so far as to corroborate that solar photolysis should be negligible relative to destruction by hydroxyl radicals. Author

N92-15439*# United Kingdom Atomic Energy Authority, Harwell (England). Modelling and Assessments Group.
THE TROPOSPHERIC LIFETIMES OF HALOCARBONS AND THEIR REACTIONS WITH OH RADICALS: AN ASSESSMENT BASED ON THE CONCENTRATION OF CO-14
Richard G. Derwent and Andreas Volz-Thomas (Kernforschungsanlage, Juelich, Germany, F.R.) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 125-146 Sponsored in part by UK Dept. of Environment Air Pollution Research Program (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Chemical reaction with hydroxyl radicals formed in the troposphere from ozone photolysis in the presence of methane, carbon monoxide and nitrogen oxides provides an important removal mechanism for halocarbons containing C-H and C = C double bonds. The isotropic distribution in atmospheric carbon monoxide was used to quantify the tropospheric hydroxyl radical distribution. Here, this methodology is reevaluated in the light of recent chemical kinetic data evaluations and new understandings gained in the life cycles of methane and carbon monoxide. None of these changes has forced a significant revision in the CO-14 approach. However, it is somewhat more clearly apparent how important basic chemical kinetic data are to the accurate establishment of the tropospheric hydroxyl radical distribution. Author

N92-15440*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, NY.
TROPOSPHERIC HYDROXYL CONCENTRATIONS AND THE LIFETIMES OF HYDROCHLOROFLUOROCARBONS (HCFCs)
Michael J. Prather *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 147-158 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Three dimensional fields of modeled tropospheric OH concentrations are used to calculate lifetimes against destruction by OH for many hydrogenated halocarbons, including the CFC alternatives. The OH fields were taken from a 3-D chemical transport model (Spivakovsky et al. 1989) that accurately simulates the global measurements of methyl chloroform (derived lifetime of 5.5 years). The lifetimes of various hydro-halocarbons are shown to be insensitive to possible spatial variations and seasonal cycles. It is possible to scale the HCFC lifetimes to that of methyl chloroform or methane by using the ratio of the rate coefficients for reaction with OH at an appropriate temperature, about 277 K. Author

N92-15441*# California Univ., Riverside.
TROPOSPHERIC REACTIONS OF THE HALOALKYL RADICALS FORMED FROM HYDROXYL RADICAL REACTION WITH A SERIES OF ALTERNATIVE FLUOROCARBONS
Roger Atkinson *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 163-205 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

In the present assessment, the hydrogen containing halocarbons being considered as alternatives to the the presently used chlorofluorocarbons are the hydrochlorofluorocarbons (HCFCs) 123 (CF3CHCl2), 141b (CFCl2CH3), 142b (CF2ClCH3), 22 (CHF2Cl) and 124 (CF3CHFCl) and the hydrofluorocarbons (HFCs) 134a (CF3CH2F), 152a (CHF2CH3) and 125 (CF3CHF2). All of these HCFCs and HFCs will react with the hydroxyl (OH) radical in the troposphere, giving rise to haloalkyl radicals which then undergo a complex series of reactions in the troposphere. These reactions of the haloalkyl radicals formed from the initial OH radical reactions with the HCFCs and HFCs under tropospheric conditions are the focus here. Author

N92-15442*# United Kingdom Atomic Energy Authority, Harwell (England). Engineering Science Div.
DEGRADATION MECHANISMS OF SELECTED HYDROCHLOROFLUOROCARBONS IN THE ATMOSPHERE: AN ASSESSMENT OF THE CURRENT KNOWLEDGE
Richard A. Cox and Robert Lesclaux (Bordeaux Univ., France) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 207-231 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Volatile organic compounds are mainly degraded in the troposphere by attack of OH with abstraction of H atoms or addition to unsaturated linkages. The chiorofluorocarbons (CFC's) do not contain these reactive sites and consequently cannot be degraded in this way in the lower atmosphere. This results in pollution of the stratosphere by these molecules and attendant problems for ozone. The proposed replacements for CFC's, the hydrochlorofluorocarbons (HCFC's), and hydrofluorocarbons (HFC's), contain at least one hydrogen atom in the molecule, which confers on these compounds a greater sensitivity toward oxidation by OH in the troposphere and in the lower stratosphere, resulting in much shorter atmospheric lifetimes than the CFC's. Consequently, the Ozone Depletion Potential and the Atmospheric Warming Potential are reduced substantially compared to the CFC's. All the possible degradation processes of the HCFC's and HFC's proposed to replace the CFC's are examined with the principal aim of identifying chlorine- and fluorine-containing products which are stable under tropospheric conditions. Author

N92-15443*# York Univ., Downsview (Ontario). Dept. of Chemistry.
AN ASSESSMENT OF POTENTIAL DEGRADATION PRODUCTS IN THE GAS-PHASE REACTIONS OF ALTERNATIVE FLUOROCARBONS IN THE TROPOSPHERE
Hiromi Niki *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 233-248 (For primary document see N92-15435 06-45)
Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Tropospheric chemical transformations of alternative hydrofluorocarbons (HCF's) and hydrochlorofluorocarbons (HCFC's) are governed by hydroxyl radical initiated oxidation processes, which are likely to be analogous to those known for alkanes and chloroalkanes. A schematic diagram is used to illustrate plausible reaction mechanisms for their atmospheric degradation, where R, R', and R" denote the F- and/or Cl-substituted alkyl groups derived from HCF's and HCFC's subsequent th the initial H atom abstraction by HO radicals. At present, virtually no kinetic data exist for the majority of these reactions, particularly for those involving RO. Potential degradation intermediates and final products include a large variety of fluorine- and/or chlorine-containing carbonyls, acids, peroxy acids, alcohols, hydrogen peroxides, nitrates and peroxy nitrates, as summarized in the attached table. Probably atmospheric lifetimes of these compounds were also estimated. For some carbonyl and nitrate products shown in this table, there seem to be no significant gas-phase removal mechanisms. Further chemical kinetics and photochemical data are needed to quantitatively assess the atmospheric fate of HCF's and HCFC's, and of the degradation products postulated in this report. Author

N92-15444*# Technische Univ., Hanover (Germany, F.R.). Inst. fuer Physikalische Chemie und Elektrochemie.
ATMOSPHERIC DEGRADATION MECHANISMS OF HYDROGEN CONTAINING CHLOROFLUOROCARBONS (HCFC) AND FLUOROCARBONS (HFC)
Reinhard Zellner *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 249-266 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

The current knowledge of atmospheric degradation of hydrogen containing chlorofluorocarbons (HCFC 22 (CHClF2), HCFC 123 (CHCl2CF3), HCFC 124 (CHClFCF3), HCFC 141b (CFCl2CH3), HCFC 142b (CF2ClCH3)) and fluorocarbons (HFC 125 (CHF2CF3), HFC 134a (CH2FCF3), HFC 152a (CHF2CH3)) is assessed. Except for the initiation reaction by OH radicals, there are virtually no experimental data available concerning the subsequent oxidative breakdown of these molecules. However, from an analogy to the degradation mechanisms of simple alkanes, some useful guidelines as to the expected intermediates and final products can be derived. A noteable exception from this analogy, however, appears for the oxi-radicals. Here, halogen substitution induces new reaction types (C-Cl and C-C bond ruptures) which are unknown to the unsubstituted analogues and which modify the nature of the expected carbonyl products. Based on an evaluation of these processes using estimated bond strength data, the following simplified rules with regards to the chlorine content of the HCFC's may be deduced: (1) HCFC's containing one chlorine atom such as 22 and 142b seem to release their chlorine content essentially instantaneous with the initial attack on the parent by OH radicals, and for HCFC 124, such release is apparently prevented; (2) HCFC's such as 123 and 141b with two chlorine atoms are expected to release only one of these instantaneously; and the second chlorine atom may be stored in potentially long-lived carbonyl compounds such as CF3CClO or CClFO. Author

N92-15445*# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.

POSSIBLE ATMOSPHERIC LIFETIMES AND CHEMICAL REACTION MECHANISMS FOR SELECTED HCFCs, HFCs, CH3CCl3, AND THEIR DEGRADATION PRODUCTS AGAINST DISSOLUTION AND/OR DEGRADATION IN SEAWATER AND CLOUDWATER

P. H. Wine and W. L. Chameides *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 271-295 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

For a wide variety of atmospheric species including CO2, HNO3, and SO2, dissolution in seawater or cloudwater followed by hydrolysis or chemical reaction represents a primary pathway for removal from the atmosphere. In order to determine if this mechanism can also remove significant amounts of atmospheric chlorofluorocarbons (HCFC's), fluorocarbons (HFC's), and their degradation products, an investigation was undertaken as part of the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS). In this investigation, the rates at which CHCl2CF3 (HCFC-123), CCl2FCH3 (HCFC-141b), CClF2CH3 (HCFC-142b), CHClF2 (HCFC-22), CHClFCF3 (HCFC-124) CH2FCF3 (HFC-134a) CHF2CH3 (HFC-152a), CHF2CF3 (HFC-125), and CH3CCl3 can be dissolved in the oceans and in cloudwater were estimated from the species' thermodynamic and chemical properties using simple mathematical formulations to simulate the transfer of gases from the atmosphere to the ocean or cloudwater. The ability of cloudwater and rainwater to remove gas phase degradation products of these compounds was also considered as was the aqueous phase chemistry of the degradation products. The results of this investigation are described. Author

N92-15446*# Du Pont de Nemours (E. I.) and Co., Wilmington, DE.

RELATIVE EFFECTS ON STRATOSPHERIC OZONE OF HALOGENATED METHANES AND ETHANES OF SOCIAL AND INDUSTRIAL INTEREST

Donald A. Fisher, Charles H. Hales, David L. Filkin, Malcolm K. W. Ko, N. Dak Sze, Peter S. Connell, Donald J. Wuebbles, Ivar S. A. Isaksen, and Frode Stordal (Oslo Univ., Norway) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 301-377 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Four atmospheric modeling groups have calculated relative effects of several halocarbons (chlorofluorocarbons (CFC's)-11, 12, 113, 114, and 115; hydrochlorofluorocarbons (HCFC's) 22, 123, 124, 141b, and 142b; hydrofluorocarbons (HFC's) 125, 134a, 143a, and 152a, carbon tetrachloride; and methyl chloroform) on stratospheric ozone. Effects on stratospheric ozone were calculated for each compound and normalized relative to the effect of CFC-11. These models include the representations for homogeneous physical and chemical processes in the middle atmosphere but do no account for either heterogeneous chemistry or polar dynamics which are important in the spring time loss of ozone over Antarctica. Relative calculated effects using a range of models compare reasonably well. Within the limits of the uncertainties of these model results, compounds now under consideration as functional replacements for fully halogenated compounds have modeled stratospheric ozone reductions of 10 percent or less of that of CFC-11. Sensitivity analyses examined the sensitivity of relative calculated effects to levels of other trace gases, assumed transport in the models, and latitudinal and seasonal local dependencies. Relative effects on polar ozone are discussed in the context of evolving information on the special processes affecting ozone, especially during polar winter-springtime. Lastly, the time dependency of relative effects were calculated. Author

N92-15447*# Du Pont de Nemours (E. I.) and Co., Wilmington, DE.

RELATIVE EFFECTS ON GLOBAL WARMING OF HALOGENATED METHANES AND ETHANES OF SOCIAL AND INDUSTRIAL INTEREST

Donald A. Fisher, Charles H. Hales, Wei-Chyung Wang, Malcolm K. W. Ko, and N. Dak Sze (Atmospheric and Environmental Research, Inc., Cambridge, MA.) *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 383-401 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

The relative potential global warming effects for several halocarbons (chlorofluorocarbons (CFC's)-11, 12, 113, 114, and 115; hydrochlorofluorocarbons (HCFC's) 22, 123, 124, 141b, and 142b; and hydrofluorocarbons (HFC's) 125, 134a, 143a, and 152a; carbon tetrachloride; and methyl chloroform) were calculated by two atmospheric modeling groups. These calculations were based on atmospheric chemistry and radiative convective models to determine the chemical profiles and the radiative processes. The resulting relative greenhouse warming when normalized to the effect of CFC-11 agree reasonably well as long as we account for differences between modeled lifetimes. Differences among results are discussed. Sensitivity of relative warming values is determined with respect to trace gas levels assumed. Transient relative global warming effects are analyzed. Author

N92-15448*# York Univ., Downsview (Ontario). Dept. of Chemistry.

AN ASSESSMENT OF POTENTIAL IMPACT OF ALTERNATIVE FLUOROCARBONS ON TROPOSPHERIC OZONE

Hiromi Niki *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 407-425 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

While the chlorofuorocarbons (CFCs) such as CFC-11 (CFCl3) and CFC-12 (CF2Cl2) are chemically inert in the troposphere, the hydrogen-containing halocarbons being considered as their replacements can, to a large extent, be removed in the troposphere by the HO radical. These alternative halocarbons include the hydrochlorofluorocarbons (HCFCs) 123 (CF3CHCl2), 141b (CFCl2CH3), 142b (CF2ClCH3), 22 (CHF2Cl), and 124 (CF3CHFCl) and the hydrofluorocarbons (HCFs) 134a (CF3CH2F), 152a

(CHF2CH3) and 125 (CF3CHF2). Listed are the rate constants (k) for the HO radical reaction of these compounds and their estimated chemical lifetimes in the troposphere. In this table, values of the lifetimes of these selected HCFCs and HCFs are seen to vary by more than a factor of more than ten ranging from 1.6 years for HFC 152a and HCFC 125 to as long as 28 years for HFC 125. Clearly, from the standpoint of avoiding or minimizing impact on stratospheric O3, those halocarbons with short tropospheric lifetimes are the desirable alternates. However, potential environmental consequences of their degradation in the troposphere should be assessed and taken into account in the selection process. Author

N92-15449*# Drexel Univ., Philadelphia, PA. Dept. of Chemistry.

NATURAL CHLORINE AND FLUORINE IN THE ATMOSPHERE, WATER AND PRECIPITATION

James P. Friend *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 431-448 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

The geochemical cycles of chlorine and fluorine are surveyed and summarized as framework for the understanding of the global natural abundances of these species in the atmosphere, water, and precipitation. In the cycles the fluxes into and out of the atmosphere can be balanced within the limits of our knowledge of the natural sources and sinks. Sea salt from the ocean surfaces represent the predominant portion of the source of chlorine. It is also an important source of atmospheric fluorine, but volcanoes are likely to be more important fluorine sources. Dry deposition of sea salt returns about 85 percent of the salt released there. Precipitation removes the remainder. Most of the sea salt materials are considered to be cyclic, moving through sea spray over the oceans and either directly back to the oceans or deposited dry and in precipitation on land, whence it runs off into rivers and streams and returns to the oceans. Most of the natural chlorine in the atmosphere is in the form of particulate chloride ion with lesser amounts as gaseous inorganic chloride and methyl chloride vapor. Fluorine is emitted from volcanoes primarily as HF. It is possible that HF may be released directly form the ocean surface but this has not been confirmed by observation. HCl and most likely HF gases are released into the atmosphere by sea salt aerosols. The mechanism for the release is likely to be the provision of protons from the so-called excess sulfate and HNO3. Sea salt aerosol contains fluorine as F(-), MgF(+), CaF(+), and NaF. The concentrations of the various species of chlorine and fluorine that characterize primarily natural, unpolluted atmospheres are summarized in tables and are discussed in relation to their fluxes through the geochemical cycle. Author

N92-15450*# State Univ. of New York, Albany. Dept. of Environmental Health and Toxicology.

TOXICOLOGY OF ATMOSPHERIC DEGRADATION PRODUCTS OF SELECTED HYDROCHLOROFLUOROCARBONS

Laurence S. Kaminsky *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 453-459 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Trifluoroacetic acid (TFA) is a liquid with a sharp biting odor. It has been proposed as the product of environmental degradation of the hydrochlorofluorocarbons HCFC-123, HCFC-124, HFC-134a, and HFC-125. Compounds HCFC-141b and HCFC-142b could yield mixed fluorochloroacetic acids, for which there is no available toxicologic data. The release of hydrochlorofluorocarbons into the environment could also give rise to HF, but the additional fluoride burden (1 to 3 ppb) in rainwater is trivial compared to levels in fluoridated drinking water (1 ppm), and would provide an insignificant risk to humans. Thus, in this paper only the toxocologic data on TFA is reviewed to assess the potential risks of environmental exposure. Author

N92-15451*# Boyce Thompson Inst. for Plant Research, Inc., Ithaca, NY.

ASSESSMENT OF EFFECTS ON VEGETATION OF DEGRADATION PRODUCTS FROM ALTERNATIVE FLUOROCARBONS

D. C. McCune and L. H. Weinstein *In* NASA, Washington, Scientific Assessment of Stratospheric Ozone: 1989, Volume 2. Appendix: AFEAS Report 1990 p 461-469 (For primary document see N92-15435 06-45)

Avail: NTIS MF A21; print copy available at WMO, Geneva, Switzerland CSCL 13B

Concern with the effects of fluorides on plants has been devoted to that resulting from dry deposition (mainly with reference to gaseous HF and secondarily with particulate forms). The occurrence of precipitation as rain or mist and the presence of dew or free water on the foliage has mainly been considered with respect to their effects on the accumulation of air-borne fluoride and not with fluoride in wet deposition. That is, precipitation has been viewed primarily with respect to its facilitation of the solution and subsequent absorption of deposits by the foliar tissues or its elution of deposited fluoride from foliage. Accordingly, our evaluation of inorganic fluoride from fluorocarbon degradation rests upon a comparison with what is known about the effects of industrial emissions and what could be considered the natural condition. Author

N92-15452*# National Aeronautics and Space Administration, Washington, DC.

REPORT OF THE INTERNATIONAL OZONE TRENDS PANEL 1988, VOLUME 1

1989 475 p Prepared in cooperation with UN Environment Programme, Nairobi, Kenya; WMO, Geneva, Switzerland; NOAA, Washington, DC; and FAA, Washington, DC Original contains color illustrations

(NASA-TM-105118; NAS 1.15:105118; GORMP-18-Vol-1) Avail: NTIS MF A20; Print copy available at WMO, Geneva, Switzerland; 6 functional color pages CSCL 13B

Chapters on the following topics are presented: spacecraft instrument calibration and stability; information content of ozone retrieval algorithms; trends in total column ozone measurements; and trends in ozone profile measurement. For individual titles, see N92-15453 through N92-15456.

N92-15453*# National Aeronautics and Space Administration, Washington, DC.

SPACECRAFT INSTRUMENT CALIBRATION AND STABILITY

J. C. Gille, P. Feldman, R. Hudson (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.), J. Lean, R. Madden, L. McMaster, G. Mount, G. Rottman, and P. C. Simon *In its* Report of the International Ozone Trends Panel 1988, Volume 1 1989 p 7-105 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15452 06-45)

Avail: NTIS MF A20; Print copy available at WMO, Geneva, Switzerland; 6 functional color pages CSCL 13B

The following topics are covered: instrument degradation; the Solar Backscatter Ultraviolet (SBUV) Experiment; the Total Ozone Mapping Spectrometer (TOMS); the Stratospheric Aerosol and Gas Experiment 1 (SAGE-1) and SAGE-2 instruments; the Solar Mesosphere Explorer (SME) UV ozone and near infrared airglow instruments; and the Limb Infrared Monitor of the Stratosphere (LIMS). Author

N92-15454*# National Aeronautics and Space Administration, Washington, DC.

INFORMATION CONTENT OF OZONE RETRIEVAL ALGORITHMS

C. Rodgers, P. K. Bhartia, W. P. Chu, R. Curran, J. DeLuisi, J. C.

Gille, R. Hudson, C. Mateer (Atmospheric Environment Service, Downsview, Ontario), D. Rusch, and R. J. Thomas et al *In its* Report of the International Ozone Trends Panel 1988, Volume 1 1989 p 107-177 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15452 06-45)

Avail: NTIS MF A20; Print copy available at WMO, Geneva, Switzerland; 6 functional color pages CSCL 13B

The algorithms are characterized that were used for production processing by the major suppliers of ozone data to show quantitatively: how the retrieved profile is related to the actual profile (This characterizes the altitude range and vertical resolution of the data); the nature of systematic errors in the retrieved profiles, including their vertical structure and relation to uncertain instrumental parameters; how trends in the real ozone are reflected in trends in the retrieved ozone profile; and how trends in other quantities (both instrumental and atmospheric) might appear as trends in the ozone profile. No serious deficiencies were found in the algorithms used in generating the major available ozone data sets. As the measurements are all indirect in someway, and the retrieved profiles have different characteristics, data from different instruments are not directly comparable. Author

N92-15455*# National Aeronautics and Space Administration, Washington, DC.

TRENDS IN TOTAL COLUMN OZONE MEASUREMENTS

F. S. Rowland, J. Angell, W. Attmannspacher, P. Bloomfield, R. D. Bojkov, N. Harris, W. Komhyr, M. McFarland, R. McPeters, and R. S. Stolarski (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.) *In its* Report of the International Ozone Trends Panel 1988, Volume 1 1989 p 179-382 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, D. C.; and FAA, Washington, DC (For primary document see N92-15452 06-45)

Avail: NTIS MF A20; Print copy available at WMO, Geneva, Switzerland; 6 functional color pages CSCL 13B

It is important to ensure the best available data are used in any determination of possible trends in total ozone in order to have the most accurate estimates of any trends and the associated uncertainties. Accordingly, the existing total ozone records were examined in considerable detail. Once the best data set has been produced, the statistical analysis must examine the data for any effects that might indicate changes in the behavior of global total ozone. The changes at any individual measuring station could be local in nature, and herein, particular attention was paid to the seasonal and latitudinal variations of total ozone, because two dimensional photochemical models indicate that any changes in total ozone would be most pronounced at high latitudes during the winter months. The conclusions derived from this detailed examination of available total ozone can be split into two categories, one concerning the quality and the other the statistical analysis of the total ozone record. Author

N92-15456*# National Aeronautics and Space Administration, Washington, DC.

TRENDS IN OZONE PROFILE MEASUREMENTS

H. Johnston, A. Aikin, R. Barnes, S. Chandra, D. Cunnold, J. DeLuisi, J. C. Gille, R. Hudson, M. P. McCormick (National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.), and L. McMaster et al *In its* Report of the International Ozone Trends Panel 1988, Volume 1 1989 p 383-441 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15452 06-45)

Avail: NTIS MF A20; Print copy available at WMO, Geneva, Switzerland; 6 functional color pages CSCL 13B

From an examination of the agreements and differences between different satellite instruments, it is difficult to believe that existing satellite instruments determine upper stratospheric ozone much better than 4 pct.; by extension, it probably would require at least a 4 pct. change to be reliably detected as a change. The best estimates of the vertical profiles of ozone change in the upper stratosphere between 1979 and 1986 are judged to be those given by the two SAGE satellite instruments. SAGE-2 minus SAGE-1 gives a much lower ozone reduction than that given by the archived Solar Backscatter UV data. The average SAGE profiles of ozone changes between 20 and 50 degs north and between 20 and 50 degs south are given. The SAGE-1 and SAGE-2 comparison gives an ozone reduction of about 4 pct. at 25 km over temperate latitudes. Five ground based Umkehr stations between 36 and 52 degs north, corrected for the effects of volcanic aerosols, report an ozone reduction between 1979 and 1987 at Umkehr layer 8 of 9 + or - 5 pct. The central estimate of upper stratospheric ozone reduction given by SAGE at 40 km is less than the central value estimated by the Umkehr method at layer 8. Author

N92-15457*# National Aeronautics and Space Administration, Washington, DC.

REPORT OF THE INTERNATIONAL OZONE TRENDS PANEL 1988, VOLUME 2

1989 404 p Prepared in cooperation with UN Environment Programme, Nairobi, Kenya; WMO, Geneva, Switzerland; NOAA, Washington, DC; and FAA, Washington, DC

(NASA-TM-105119; NAS 1.15:105119; GORMP-18-Vol-2) Avail: NTIS HC/MF A18 CSCL 13B

Chapters on the following topics are presented: trends in stratospheric temperature; theory and observations- model simulations of the period 1955-1985; trends in source gases; trends in stratospheric minor constituents; trends in aerosol abundances and distribution; and observations and theories related to antarctic ozone. For individual titles, see N92-15458 through N92-15463.

N92-15458*# National Aeronautics and Space Administration, Washington, DC.

TRENDS IN STRATOSPHERIC TEMPERATURE

M. R. Schoeberl, P. A. Newman, J. E. Rosenfield, J. Angell, J. Barnett, B. A. Boville (National Center for Atmospheric Research, Boulder, CO.), S. Chandra, S. Fels, E. Fleming, and M. Gelman et al *In its* Report of the International Ozone Trends Panel 1988, Volume 2 1989 p 443-498 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15457 06-45)

Avail: NTIS HC/MF A18 CSCL 13B

Stratospheric temperatures for long-term and recent trends and the determination of whether observed changes in upper stratospheric temperatures are consistent with observed ozone changes are discussed. The long-term temperature trends were determined up to 30mb from radiosonde analysis (since 1970) and rocketsondes (since 1969 and 1973) up to the lower mesosphere, principally in the Northern Hemisphere. The more recent trends (since 1979) incorporate satellite observations. The mechanisms that can produce recent temperature trends in the stratosphere are discussed. The following general effects are discussed: changes in ozone, changes in other radiatively active trace gases, changes in aerosols, changes in solar flux, and dynamical changes. Computations were made to estimate the temperature changes associated with the upper stratospheric ozone changes reported by the Solar Backscatter Ultraviolet (SBUV) instrument aboard Nimbus-7 and the Stratospheric Aerosol and Gas Experiment (SAGE) instruments. Author

N92-15459*# National Aeronautics and Space Administration, Washington, DC.

THEORY AND OBSERVATIONS: MODEL SIMULATIONS OF THE PERIOD 1955-1985

Ivar S. A. Isaksen, R. Eckman, A. Lacis, Malcolm K. W. Ko, M. Prather, J. Pyle, H. Rodhe, Frode Stordal, R. S. Stolarski (National Aeronautics and Space Administration. Goddard Space Flight

Center, Greenbelt, MD.), and R. P. Turco et al *In its* Report of the International Ozone Trends Panel 1988, Volume 2 1989 p 499-542 (For primary document see N92-15457 06-45)
Avail: NTIS HC/MF A18 CSCL 13B

The main objective of the theoretical studies presented here is to apply models of stratospheric chemistry and transport in order to understand the processes that control stratospheric ozone and that are responsible for the observed variations. The model calculations are intended to simulate the observed behavior of atmospheric ozone over the past three decades (1955-1985), for which there exists a substantial record of both ground-based and, more recently, satellite measurements. Ozone concentrations in the atmosphere vary on different time scales and for several different causes. The models described here were designed to simulate the effect on ozone of changes in the concentration of such trace gases as CFC, CH4, N2O, and CO2. Changes from year to year in ultraviolet radiation associated with the solar cycle are also included in the models. A third source of variability explicitly considered is the sporadic introduction of large amounts of NO sub x into the stratosphere during atmospheric nuclear tests.
Author

N92-15460*# National Aeronautics and Space Administration, Washington, DC.
TRENDS IN SOURCE GASES
D. H. Ehhalt, P. J. Fraser, D. Albritton (National Oceanic and Atmospheric Administration, Boulder, CO.), R. J. Cicerone, M. A. K. Khalil, M. Legrand, Y. Makide, F. S. Rowland, L. P. Steele, and R. Zander *In its* Report of the International Ozone Trends Panel 1988, Volume 2 1989 p 543-569 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland; NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15457 06-45)
Avail: NTIS HC/MF A18 CSCL 13B

Source gases are defined as those gases that, by their breakdown, introduce into the stratosphere halogen, hydrogen, and nitrogen compounds that are important in stratospheric ozone destruction. Given here is an update of the existing concentration time series for chlorocarbons, nitrous oxide, and methane. Also reviewed is information on halogen containing species and the use of these data for establishing trends. Also reviewed is evidence on trends in trace gases that influence tropospheric chemistry and thus the tropospheric lifetimes of source gases, such as carbon dioxide, carbon monoxide, or nitrogen oxides. Much of the information is given in tabular form.
Author

N92-15461*# National Aeronautics and Space Administration, Washington, DC.
TRENDS IN STRATOSPHERIC MINOR CONSTITUENTS
R. S. Stolarski, W. P. Chu (National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.), M. T. Coffey, W. S. Heaps, J. A. Kaye, M. P. McCormick, and R. Zander *In its* Report of the International Ozone Trends Panel 1988, Volume 2 1989 p 571-593 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneve (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15457 06-45)
Avail: NTIS HC/MF A18 CSCL 13B

Photochemical models predict that increasing source gas concentrations are also expected to lead to changes in the concentrations of both catalytically active radical species (such as NO2, ClO, and OH) and inactive reservoir species (such as HNO3, HCl, and H2O). For simplicity, we will refer to all these as trace species. Those species that are expected to have increasing concentration levels are investigated. Additionally, the trace species concentration levels are monitored for unexpected changes on the basis of the measure increase in source gases. Carrying out these investigations is difficult due to the limited data base of measurements of stratospheric trace species. In situ measurements are made only infrequently, and there are few satelliteborne measurements, most over a time space insufficient for trend determination. Instead, ground-based measurements of column content must be used for many species, and interpretation is complicated by contributions from the troposphere or mesosphere or both. In this chapter, we examine existing measurements as published or tabulated.
Author

N92-15462*# National Aeronautics and Space Administration, Washington, DC.
TRENDS IN AEROSOL ABUNDANCES AND DISTRIBUTIONS
R. P. Turco, M. P. McCormick, R. T. Clancy, R. Curran, J. DeLuisi (National Oceanic and Atmospheric Administration, Boulder, CO.), P. Hamill, G. Kent, J. M. Rosen, O. B. Toon, and G. Yue *In its* Report of the International Ozone Trends Panel 1988, Volume 2 1989 p 595-664 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15457 06-45)
Avail: NTIS HC/MF A18 CSCL 13B

The properties of aerosols that reside in the upper atmosphere are described. Special emphasis is given to the influence these aerosols have on ozone observation systems, mainly through radiative effects, and on ambient ozone concentrations, mainly through chemical effects. It has long been appreciated that stratospheric particles can interfere with the remote sensing of ozone distribution. The mechanism and magnitude of this interference are evaluated. Separate sections deal with the optical properties of upper atmospheric aerosols, long-term trends in stratospheric aerosols, perturbations of the stratospheric aerosol layer by volcanic eruptions, and estimates of the impacts that such particles have on remotely measured ozone concentrations. Another section is devoted to a discussion of the polar stratospheric clouds (PSC's). These unique clouds, recently discovered by satellite observation, are now thought to be intimately connected with the Antarctic ozone hole. Accordingly, interest in PSC's has grown considerably in recent years. This chapter describes what we know about the morphology, physical chemistry, and microphysics of PSC's.
Author

N92-15463*# National Aeronautics and Space Administration, Washington, DC.
OBSERVATIONS AND THEORIES RELATED TO ANTARCTIC OZONE CHANGES
D. Hartmann, R. T. Watson, Richard A. Cox, C. Kolb, J. Mahlman, M. McElroy, A. Plumb, V. Ramanathan, M. Schoeberl, and S. Solomon (National Oceanic and Atmospheric Administration, Boulder, CO.) et al *In its* Report of the International Ozone Trends Panel 1988, Volume 2 1989 p 665-750 Prepared in cooperation with United Nations Environment Programme, Nairobi (Kenya); World Meteorological Organization, Geneva (Switzerland); NOAA, Washington, DC; and FAA, Washington, DC (For primary document see N92-15457 06-45)
Avail: NTIS HC/MF A18 CSCL 13B

In 1985, there was a report of a large, sudden, and unanticipated decrease in the abundance of springtime Antarctic ozone over the last decade. By 1987, ozone decreases of more than 50 percent in the total column, and 95 percent locally between 15 and 20 km, had been observed. The scientific community quickly rose to the challenge of explaining this remarkable discovery; theoreticians soon developed a series of chemical and dynamical hypotheses to explain the ozone loss. Three basic theories were proposed to explain the springtime ozone hole. (1) The ozone hole is caused by the increasing atmospheric loadings of manmade chemicals containing chlorine (chlorofluorocarbons (CFC's) and bromine (halons)). These chemicals efficiently destroy ozone in the lower stratosphere in the Antarctic because of the special geophysical conditions, of an isolated air mass (polar vortex) with very cold temperatures, that exist there. (2) The circulation of the atmosphere in spring has changed from being predominantly downward over Antarctica to upward. This would mean that ozone poor air from the troposphere, instead of ozone rich air from the upper stratosphere, would be transported into the lower Antarctic stratosphere. (3) The abundance of the oxides of nitrogen in the

lower Antarctic stratosphere is periodically enhanced by solar activity. Nitrogen oxides are produced in the upper mesosphere and thermosphere and then transported downward into the lower stratosphere in Antarctica, resulting in the chemical destruction of ozone. The climatology and trends of ozone, temperature, and polar stratospheric clouds are discussed. Also, the transport and chemical theories for the Antarctic ozone hole are presented. Author

N92-15464*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY
L. Bernard Garrett, ed., Warren D. Hypes, ed. (Bionetics Corp., Hampton, VA.), and Robert L. Wright, ed. Sep. 1991 397 p (NASA-TM-104128; NAS 1.15:104128) Avail: NTIS HC/MF A17 CSCL 13B

Described here is an architecture trade study conducted by the Langley Research Center to develop a representative mix of advanced space science instrumentation, spacecraft, and mission orbits to assist in the technology selection processes. The analyses concentrated on the highest priority classes of global change measurements which are the global climate changes. Issues addressed in the tradeoffs includes assessments of the economics of scale of large platforms with multiple instruments relative to smaller spacecraft; the influences of current and possible future launch vehicles on payload sizes, and on-orbit assembly decisions; and the respective roles of low-Earth versus geostationary Earth orbiting systems. For individual titles, see N92-15465 through N92-15476.

N92-15465*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SCIENCE REQUIREMENTS FOR A GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY
John T. Suttles, Edwin F. Harrison, Gary G. Gibson (Lockheed Engineering and Sciences Co., Hampton, VA.), and Thomas G. Campbell *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study Sep. 1991 p 73-89 Previously announced as N91-25558 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 13B

Science requirements for a Global Change Technology Initiative (GCTI) Architecture Trade Study were established by reviewing and synthesizing results from recent studies. A scientific rationale was adopted and used to identify a comprehensive set of measurables and their priorities. Spatial and temporal requirements for a number of measurement parameters were evaluated based on results from several working group studies. Science requirements were defined using these study results in conjunction with guidelines for investigating global changes over a time scale of decades to centuries. Requirements are given separately for global studies and regional process studies. For global studies, temporal requirements are for sampling every 1 to 12 hours for atmospheric and radiation parameters and 1 day or more for most Earth surface measurements. Therefore, the atmospheric measurables provide the most critical drivers for temporal sampling. Spatial sampling requirements vary from 1 km for land and ocean surface characteristics to 50 km for some atmospheric parameters. Thus, the land and ocean surface parameters have the more significant spatial variations and provide the most challenging spatial sampling requirements. Author

N92-15466*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SATELLITE ORBIT CONSIDERATIONS FOR A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY **c13**
Edwin F. Harrison, Gary G. Gibson, John T. Suttles, James J. Buglia, and Israel Taback (Bionetics Corp., Hampton, VA.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 91-108 Previously announced as N91-25557 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22A

A study was conducted to determine satellite orbits for Earth observation missions aimed at obtaining data for assessing global climate change. A multisatellite system is required to meet the scientific requirements for temporal coverage over the globe. The best system consists of four Sun-synchronous satellites equally spaced in local time of equatorial crossing. This system can obtain data every three hours for all regions. Several other satellite systems consisting of combinations of Sun-synchronous orbits and either the Space Station Freedom or a mid-latitude equatorial satellite can provide three to six hour temporal coverage, which is sufficient for measuring many of the parameters required for the global change monitoring mission. Geosynchronous satellites are required to study atmospheric and surface processes involving variations on the order of a few minutes to an hour. Two or more geosynchronous satellites can be relocated in longitude to study processes over selected regions of Earth. Author

N92-15467*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SELECTION OF REPRESENTATIVE INSTRUMENTS FOR A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY **c35**
Warren D. Hypes, Lloyd Keafer, Rogard T. Ross, Heather R. Knight (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.), Anthony Jalink, and Cheryl L. Allen *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 109-179 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 14B

The objectives of Task 2 of the Global Change Technology Initiative (GCTI) Architectural Trade Study were to select representative sets of instruments for making the science measurements specified in Task 1 and to identify instruments that, when flown together, form special complementary packages for measurement purposes. The list of representative instruments and their complementary relationships provide a payload manifest defined in terms of mass, power, size, viewing angles, data rates, etc. which can be used to focus spacecraft trade studies and the definition of a candidate GCTI fleet. Science requirements from Task 1 are given in tabular form. Numerous instruments are described, including visible-infrared radiometers, visible-infrared spectrometers, gas correction radiometers, active systems for Earth observation, Limb viewing instruments, visible-infrared and grating spectrometers, and microwave radiometers. Author

N92-15468*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MICROWAVE SENSING TECHNOLOGY ISSUES RELATED TO A GLOBAL CHANGE TECHNOLOGY ARCHITECTURE TRADE STUDY **c43**
Thomas G. Campbell, Jim Shiue, Denis Connolly, and Ken Woo (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 181-186 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 13B

The objectives are to enable the development of lighter and less power consuming, high resolution microwave sensors which will operate at frequencies from 1 to 200 GHz. These systems will use large aperture antenna systems (both reflector and phased arrays) capable of wide scan angle, high polarization purity, and utilize sidelobe suppression techniques as required. Essentially, the success of this technology program will enable high resolution microwave radiometers from geostationary orbit, lightweight and more efficient radar systems from low Earth orbit, and eliminate mechanical scanning methods to the fullest extent possible; a main source of platform instability in large space systems. The Global Change Technology Initiative (GCTI) will develop technology which will enable the use of satellite systems for Earth observations on a global scale. Author

N92-15469*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUNSYNCHRONOUS LOW EARTH ORBIT SPACECRAFT CONCEPTS AND TECHNOLOGY REQUIREMENTS FOR GLOBAL CHANGE MONITORING c18
L. Bernard Garrett, Ansel J. Butterfield, Israel Taback, Paul A. Garn, and Donald R. Burrowbridge, Jr. (Spartan Space Services, Glendale, AZ.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 187-270 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

The Global Change Technology Initiative listing of instruments for operation in low Earth, sunsynchronous orbits contain 21 entries, of which 20 are carried aboard multi-instrument spacecraft. This list identifies the temporal requirements for repetition of measurements and also includes groups of instruments that make complementing measurements. Definitions for individual spacecraft follows the temporal and grouping requirements to establish constellations which will provide the measurement data. The definitions of constellations for multi-instrument spacecraft show two alternatives: a constellation of 10 spacecraft, each compatible with launch by a Delta booster; a constellation of 4 spacecraft, each requiring a Titan booster. Operating subsystems for the individual spacecraft can use modular concepts that are adaptations based upon current plans for improving the performance of the NASA-Goddard Multimission Modular units. The descriptions of the spacecraft and constellations begins with a compilation of instrument related requirements that define the principal system performance parameters and operating capabilities. Author

N92-15470*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HOOP COLUMN SOIL MOISTURE SPACECRAFT IN LOW EARTH ORBIT FOR GLOBAL CHANGE MONITORING c18
Melvin J. Ferebee, Jr. *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 271-280 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

A subset of the total Global Change Technology Initiative instruments are required to be in low Earth, sunsynchronous orbits. There is one instrument, however, that requires its own specialized spacecraft; the Soil Moisture Microwave Radiometer (SMMR). The characteristic structure of the instrument is the 118 m hoop column support structure. The hoop is supported by an axially placed column. Tension cables support and shape an electromagnetically reflective mesh surface. The instrument is capable of detecting frequencies in the 1.4 GHz range (Soil Moisture and Sea Salinity). Three apertures are used to reduce the degree of paraboloid offset and improve the beam quality. The spacecraft configuration is determined by the instrument support requirements and the requirement that it can fit into the Titan IV cargo bay. The configuration is derived by cross referencing the instrument performance requirements with the performance of the spacecraft. The spacecraft design is similar with the Multi-mission Modular Spacecraft in terms of size and packaging. A description of the spacecraft's features will yield a summary of the technologies needed for the SMMR spacecraft. Author

N92-15471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GEOSTATIONARY ORBIT EARTH SCIENCE PLATFORM CONCEPTS FOR GLOBAL CHANGE MONITORING c18
Jeffery T. Farmer, Thomas G. Campbell, William T. Davis, Paul A. Garn, Charles B. King, and Cheryl C. Jackson (Flight Mechanics and Control, Inc., Hampton, VA.) *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 282-291 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

Functionality of a geostationary spacecraft to support Earth science regional process research is identified. Most regional process studies require high spatial and temporal resolution. These high temporal resolutions are on the order of 30 minutes and may be achievable with instruments positioned in a geostationary orbit. A complement of typical existing or near term instruments are identified to take advantage of this altitude. This set of instruments is listed, and the requirements these instruments impose on a spacecraft are discussed. A brief description of the geostationary spacecraft concepts which support these instruments is presented. Author

N92-15472*# Bionetics Corp., Hampton, VA.
OPTIONS IN THE GLOBAL CHANGE FLEET ARCHITECTURE PROVIDED BY THE PRESENCE OF AN EOS-A AND -B c18
Warren D. Hypes and Rogard T. Ross (Joint Inst. for Advancement of Flight Sciences, Hampton, VA.) *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study Sep. 1991 p 293-308 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 22B

The baseline architecture of the Global Change Technology Initiative (GCTI) fleet was established by selecting and designing spacecraft and instruments to meet the science requirements developed under the task 1 effort. While attempting to meet the temporal sampling portion of the science requirements, no consideration was given to the presence of the proposed Earth Observing System (EOS) Spacecraft that would be making many of the same measurements with many of the same instruments. After establishing the GCTI baseline independent of the EOS Spacecraft; however, it is now prudent to examine the impact of the presence of the EOS Spacecraft on the GCTI fleet. A small scope, GCTI study supplement was accomplished to assess the impact. The content and results of the supplementary study are presented. Author

N92-15473*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INFORMATION DATA SYSTEMS FOR A GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY c82
Nicholas D. Murray *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 309-338 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 05B

The Global Change Technology Initiative (GCTI) was established to develop technology which will enable use of satellite systems of Earth observations on a global scale, enable use of the observations to predictively model Earth's changes, and provide scientists, government, business, and industry with quick access to the resulting information. At LaRC, a GCTI Architecture Trade Study was undertaken to develop and evaluate the architectural implications to meet the requirements of the global change studies and the eventual implementation of a global change system. The output of the trade study are recommended technologies for the GCTI. That portion of the study concerned with the information data system is documented. The information data system for an earth global change modeling system can be very extensive and beyond affordability in terms of today's costs. Therefore, an incremental approach to gaining a system is most likely. An options approach to levels of capability versus needed technologies was developed. The primary drivers of the requirements for the information data system evaluation were the needed science products, the science measurements, the spacecraft orbits, the instruments configurations, and the spacecraft configurations and their attendant architectures. The science products requirements were not studied here; however, some consideration of the product needs were included in the evaluation results. The information data system technology items were identified from the viewpoint of the desirable overall information system characteristics.
Author

N92-15474*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY PLAN
In its Global Change Technology Architecture Trade Study Sep.

1991 p 341-349 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 13B

The overall objective of the trade study is to define the architectural mix of missions, spacecraft/platforms, and sensors to meet the science requirements of the Mission to Planet Earth/Global Change Technology Initiative (MPE/GCTI) beyond the early Earth Observing System (Eos) and Geosynchronous Earth Orbit (GEO) spacecraft missions. Within the overall objective, the study includes the following specific objectives: (1) Substantiate the selected mix of Low Earth Orbit (LEO), GEO, or intermediate orbit spacecraft/platforms; (2) Define the required number and size of spacecraft related to objective (1); (3) Define a generic sensor complement for the spacecraft/platforms; (4) Evaluate current spacecraft capabilities to meet the mission requirements and develop conceptual designs of spacecraft/platforms as required. (5) Identify advanced or new technology needed to most efficiently accomplish the MPE/GCTI Program. Author

N92-15475*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
PHYSICAL AND PERFORMANCE CHARACTERISTICS OF INSTRUMENTS SELECTED FOR GLOBAL CHANGE MONITORING **c35**
Cheryl L. Allen *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 351-379 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 14B

The following appendix (appendix B) lists the instruments chosen for the Global Change Monitoring program. The instruments are described according to the following categories: (1) Title; (2) Measurement; (3) Contact; (4) Instrument Type; (5) Dimensions; (6) Mass; (7) Average Operational Power; (8) Data Rate; (9) Spectral/Frequency Range; (10) Number of Channels/Frequencies; (11) Viewing Field; (12) Scanning Characteristics; (13) Resolution (Horizontal/Vertical); (14) Swath Width; (15) Satellite Application; and (16) Technology Status. A technical drawing of each instrument is also provided. D.R.D.

N92-15476*# Joint Inst. for Advancement of Flight Sciences, Hampton, VA.
PLOTS OF GROUND COVERAGE ACHIEVEABLE BY GLOBAL CHANGE MONITORING INSTRUMENTS AND SPACECRAFT **c43**
Heather R. Knight and Lynda Foernsler (Auburn Univ., AL.) *In* NASA. Langley Research Center, Global Change Technology Architecture Trade Study Sep. 1991 p 381-411 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 08B

Low Earth Orbit (LEO) and Geosynchronous Earth Orbit (GEO) satellite plots are given. All satellites are in an 800 km circular orbit at an inclination of 98.6 deg (sun synchronous). Specifics of the instrument package are given. Additionally, the time period of the plot and the percentage of the Earth covered during the time period are listed. Author

N92-15477# Harvard Univ., Cambridge, MA. Dept. of Organismic and Evolutionary Biology.
PREDICTING THE RESPONSE OF A TEMPERATE FOREST ECOSYSTEM TO ATMOSPHERIC CO2 INCREASE
F. A. Bazzaz 1991 18 p
(Contract DE-FG02-84ER-60257)
(DE92-001943; DOE/ER-60257/T1) Avail: NTIS HC/MF A03

All research goals for the current year have been met. We have prepared eight manuscripts reporting these discoveries. Individual projects have determined that soil volume is not critical to the decline of photosynthetic rates under elevated CO2. However, the shape, as well as the size, exerts a strong influence on growth in response to elevated CO2, but this response is variable dependent on the species. Elevated CO2 may increase the growth of shade-tolerant trees to a greater extent than shade-intolerant trees. All birch trees examined responded in a similar positive way to a doubling of CO2, but only yellow birch showed an increase in survival. Seedling regeneration in a New England deciduous forest may be altered by future CO2 levels. Plants grown in a high CO2 atmosphere altered their physiological functions, growth rates, biomass, and allometric growth patterns, probably influencing individual survival and plant/plant interactions within a community. The changes in photosynthetic rate (Ps) in response to elevated CO2 may involve alteration of multiple physiological characteristics. Growth enhancement in elevated CO2 is contingent on soil moisture conditions. Model simulations show increases in plant survival under elevated CO2 can have unexpected results on population dynamics. Finally, CO2 levels do not affect the heat shock response. Future experiments are described. DOE

N92-15478# Beleidscommissie Remote Sensing, Delft (Netherlands).
TOWARDS THE OPERATIONALISATION OF NOAA/AVHRR PRODUCTS FOR THE PURPOSES OF MARINE ECOLOGY RESEARCH
Lydia Harkink (Rijkswaterstaat, Delft, Netherlands) Jun. 1991 67 p Original contains color illustrations
(BCRS-91-09; ETN-92-90440) Avail: NTIS HC/MF A04

Investigation of the applicability of NOAA/AVHRR (Advanced Very High Resolution Radiometer) images and derived products (sea surface temperature and total suspended matter images) indicate that these products might be useful for monitoring studies of the North Sea. Therefore, further research was formulated on the applicability of interpreted NOAA/AVHRR images in ecological studies of the North Sea. Particular attention was devoted to the operationalization of NOAA/AVHRR products in two major projects, eutrophication of saline waters (EUZOUT) and north sea micropollutants (NOMIVE), because these projects together cover a broad area of this research. Research was also performed into the derivation of the downward irradiance attenuation coefficient from data provided by the AVHRR images. Similarly, because of the increasing concern over eutrophication problems, research was carried out on possibilities for the detection of algal blooms with the aid of AVHRR products. These blooms are occurring with ever increasing frequency on sea surfaces. In the NOMIVE project there was a need for both qualitative and quantitative data on suspended matter and performance. Results are presented. ESA

N92-15479# Stockholm Univ. (Sweden). Dept. of Meteorology.
SAMPLING AND ANALYSIS OF ATMOSPHERIC MONOTERPENES
Robert Janson and Jan Kristensson 21 Aug. 1991 19 p
(CM-79; ISSN-0280-445X; ETN-92-90723) Avail: NTIS HC/MF A03

Techniques and quality tests for sampling and analysis of the terpenes are described, including gas phase calibration results. Results from air samples taken in a Scots Pine forest in central Sweden are given. Monoterpenes from one liter air samples are absorbed on Tenax TA and analysis is done with gas chromatography and mass selective detection. Nine terpenes were separated. Quantification is done by peak area for mass fragment m/e = 93, 67 (limonene) or 69 (myrcene). A permeation device system was used to generate test atmospheres. Up to 3 litres of ozone free air can be sampled at 100 to 300 ml/min on 200 mg Tenax without losing sampling efficiency. A maximum loss of 10 percent limonene is observed after 9 days storage of samples. Gas phase calibrations were found to agree with liquid phase calibrations for alpha-pinene, camphene, and limonene, but not beta-pinene and 3-carene. Alpha-pinene, camphene, beta-pinene, 3-carene, myrcene, alpha-phellandrene, and limonene were positively identified in ambient air samples. Sabinene and alpha-phellandrene were tentatively identified by comparison with relative retention times from the literature. ESA

N92-15480# Argonne National Lab., IL.
CHARACTERISTICS OF LARGE EDDY TRANSPORT BETWEEN THE LOWER ATMOSPHERE AND A DECIDUOUS FOREST

Weigang Gao, Roger H. Shaw, and Kyaw Tha PawU (California Univ., Davis.) 1991 4 p Presented at the 20th Conference on Agricultural and Forest Meteorology, Salt Lake City, UT, 10-13 Sep. 1991
(Contract W-31-109-eng-38)
(DE91-018636; ANL/CP-73320; CONF-9109203-2) Avail: NTIS HC/MF A01

Bulk characteristics of mean upward and downward flows have been examined by applying conditional averaging to the data collected within and above a deciduous forest. The time fraction of updrafts is longer than that of downdrafts within the canopy, but the time fractions tend to be equally distributed at about twice the canopy height. This characteristic appears to be generally independent of canopy Leaf Area Index and atmospheric stability. The asymmetric time distribution over updrafts and downdrafts and the strong height dependence of this distribution are caused by weak upwelling flows and strong descending motions existing within the canopy region. The vertical transport contributed by mean vertical motions accounts for an important part of the total fluxes. Although the ratio of the flux by mean vertical motions to the total flux changes with height, it appears to be invariant with canopy Leaf Area Index and atmospheric stability. DOE

N92-15481# Mar, Inc., Rockville, MD.
NATIONAL STRIKE FORCE (NSF) OIL SPILL RESPONSE EQUIPMENT UPGRADE Final Report
Oct. 1991 65 p
(Contract N00167-89-D-0005)
(AD-A242434; CG-D-06-91) Avail: NTIS HC/MF A04 CSCL 24/3

Current options for upgrading oil spill response equipment for the Coast Guard's National Strike Force (NSF) were investigated. Specific systems and equipment addressed included oil/water separation systems, temporary storage devices, skimmers and pumps. In addition, a concept for an alternative design for the NSF's skimming barrier retrieval system has been proposed. A worldwide survey of oil spill response equipment was conducted to identify candidate replacement equipment. Evaluation criteria were developed and applied in the screening of prospective equipment. Generic test and evaluation parameters are presented to provide a means of assisting in future evaluations of potential equipment. GRA

N92-15482# Oak Ridge National Lab., TN.
ENVIRONMENTAL PROTECTION FOR HAZARDOUS MATERIALS INCIDENTS. VOLUME 1: HAZARDOUS MATERIALS INCIDENT MANAGEMENT SYSTEM Final Report, Oct. 1986 - Jun. 1990
B. D. Barkenbus, R. J. Carter, J. E. Dobson, C. E. Easterly, and P. S. Ogle Nov. 1990 367 p
(Contract DE-AC05-8404-21400; AF Proj. 2505)
(AD-A242521; AFESC/ESL-TR-89-15-Vol-1) Avail: NTIS HC/MF A16 CSCL 13/12

The primary mission of the Environmental Protection for Hazardous Materials (HAZMAT's) Incidents Project was to assist U.S. Air Force (USAF) fire department personnel in HAZMAT incident management. This objective involved: (1) a definition of the extent of HAZMAT's; (2) a review of pertinent regulations and job requirements pertaining to HAZMAT incidents including decision making and response during emergencies; (3) identification and refinement of a computer-assisted incident management system; and (4) a definition of HAZMAT-related issues for fire department personnel, including, training, and protective clothing. Within the framework of the objective, all major HAZMAT-incident related issues were identified and, to some extent, characterized. Included are proposed solutions to identified problems. GRA

N92-15483# Washington Univ., Saint Louis, MO. Center for Air Pollution Impact and Trend Analysis.
COMPOSITION OF AEROSOLS OVER THE CONTINENTAL US Report, 16 Apr. 1990 - 16 Mar. 1991
Bret A. Schichtel and Rudolf B. Husar 12 Jul. 1991 132 p
(Contract F19628-87-K-0003)
(AD-A242536; PL-TR-91-2180; SR-3) Avail: NTIS HC/MF A07 CSCL 13/2

This study examines and integrates two databases containing aerosol species for the fine mass from the NPS-NFPN and NESCAUM monitoring networks. The coarse mass for the NPS-NFPN network is also examined. These networks operated in different parts of the United States, and over different time periods. The final database is then partitioned into the major aerosol types for the four quarters of the year. Equations are developed to partition the fine and coarse aerosol mass into sulfate, ammonia, water, organic, soil, soot, and salt aerosol types. The equations estimate these aerosol types by scaling up tracer species characteristic for specific source types. Any scaling factors which could not be determined from the assumed chemical composition of the aerosol types were found through a fitting process. Results of the partitioning agree with previous studies and alternative means of estimation. However, more reasonable results are found if the two databases are treated separately than combined. The largest observed fine particle mass occurs in the eastern part of the U.S. where it is dominated by sulfur aerosol types (sulfate, ammonia, and water) and organics constituting approximately 80 percent of the mass. These aerosol types reach a maximum during the third quarter of the year. GRA

N92-15484# Environmental Research Inst. of Michigan, Ann Arbor. Image Processing Systems Div.
IDAPS COLOR FILM CHARACTERIZATION: DRAFT FOR REVIEW
John Hemdal, Charles Lake, and David Symanow Apr. 1991 19 p
(AD-A242681; ERIM-217000-45-T) Avail: NTIS HC/MF A03 CSCL 14/4

The focus of this effort was to determine the utility of color imagery in the GADS environment. In particular, we were looking for improved edge extraction. The underlying assumption driving this investigation was that desirable edges could be detected using color when their presence was either weak or imperceptible in the monochrome imagery. Presumably, the stronger edges from color exploitation would enhance the performance of Auto-GADS, or at least aid an operator in manual operations. It is reasonable to assume that along with more desirable edges there will be an increased presence of undesirable edges, i.e., clutter. The sensitivity of GADS operations to clutter were not addressed in this particular effort. GADS operations rely upon matching a wire frame model to edges in the data. The accuracy requirements of this match are quite strict. Thus, any bias or distortion of extracted edges arising from the color exploitation process could result in a failure to meet accuracy specifications. While this possibility appeared remote, a significant portion of this effort was directed towards determining if any shifts were present and the nature of their origin. GRA

N92-15485# Argonne National Lab., IL.
EVALUATION OF CHEMICAL REAGENTS FOR QUICK ESTIMATION OF AIR-BORNE LEAD CONCENTRATIONS Final Report, 1 Oct. - 31 Dec. 1990
Daniel Lawson and Solomon Zaromb Aug. 1991 64 p
(Contract N68305-90-WR-00185)
(AD-A242710; NCEL-CR-91.009) Avail: NTIS HC/MF A04 CSCL 24/1

This report summarizes research to determine the feasibility of methods to estimate air-borne lead and lead compounds in and around Navy small arms firing ranges. A two-step method that received initial attention was: (1) solubilizing air-borne lead in a liquid extractant, and (2) rapid detection and quantitative analysis of the lead concentration in the extractant through use of an indicator tape or reagent. This preliminary investigation led to the recommendation for monitoring airborne lead: (1) develop a kit consisting of tbe Portable High-Throughput Liquid Absorption Air and Aerosol Sampler and either Quant Lead Test Strips or an electrochemical analyzer, such as Electrascan; or (2) develop an automated stationary or transportable system using a

high-throughput filter cartridge, such as MiniKap 500 in conjunction with an electrochemical analyzer. Ideally, these two alternatives could be used in a complementary way, with the portable unit serving to identify locations that will require continuous monitoring by the automated system. Although the preliminary investigations are promising, more RDT and E remains to be done before either of the systems can be installed in the field. GRA

N92-15486# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
DETERMINATION OF URANIUM AND ITS ISOTOPIC RATIOS IN ENVIRONMENTAL SAMPLES M.S. Thesis
M. S. M. FluesSzeles 1990 86 p In PORTUGUESE; ENGLISH summary
(DE91-640001; INIS-BR-2658) Avail: NTIS HC/MF A05

A method for the determination of uranium and its isotopic ratios U-235/U-238 and U-234/U-238 is established in the present work. The method can be applied in environmental monitoring programs of uranium enrichment facilities. The proposed method is based on the alpha spectrometry technique which is applied after a purification of the sample by using an ionic exchange resin. The total yield achieved was (91 + 5) percent with a precision of 5 percent, an accuracy of 8 percent, and a lower limit of detection of 7,9 x 10 Bq(-4). The uranium determination in samples containing a high concentration of iron, which is an interfering element present in environmental samples, particularly in soil and sediment, was also studied. The results obtained by using artificial samples containing iron and uranium in the ratio 1000:1 were considered satisfactory. DOE

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N92-15487# Swedish Inst. of Space Physics, Kiruna. Geophysical Inst.
INCOHERENT SCATTER STUDIES OF UPPER ATMOSPHERE DYNAMICS AND CODING TECHNIQUE Thesis
Ingemar Haeggstroem Sep. 1990 166 p Original contains color illustrations
(IRF-SR-204; ISBN-91-7174-524-6; ISSN-0284-1703; ETN-91-99901) Avail: NTIS HC/MF A08

A technique to determine the thermospheric neutral wind from incoherent scatter measurements is described. Simultaneous Fabry-Perot interferometer measurements of the wind are compared with those derived from the radar data. The uncertainties are discussed. F region electron density depletions in the afternoon evening sector of the auroral zone, identified as the main ionospheric trough, are investigated. An empirical model predicting the latitude of the trough is proposed. A new coding technique for incoherent scatter radar measurements is introduced and described. Two examples of application of the alternating codes are presented, showing the high quality data obtained in these experiments. Seven separate papers related to this research are included as part of this report. For individual titles, see N92-15488 through N92-15494.

N92-15488# Swedish Inst. of Space Physics, Kiruna. Geophysical Inst.
DETERMINATION OF THE THERMOSPHERIC NEUTRAL WIND FROM INCOHERENT SCATTER RADAR MEASUREMENTS
Ingemar Haeggstroem, J. Murdin, and D. Rees (University Coll., London, England) *In its* Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technique Sep. 1990 26 p Previously announced as N86-31178 Original contains color illustrations (For primary document see N92-15487 06-46)
(KGI-186; ISSN-0347-6405) Avail: NTIS HC/MF A08

Measurements made by the European Incoherent Scatter facility (EISCAT) utrahigh frequency (UHF) incoherent scatter radar are used to derive thermospheric winds. The formalism for the calculation of the F region neutral wind is given using the momentum and energy equations. The derived wind is compared to Fabry-Perot interferometer measurements of the neutral wind made simultaneously. The uncertainties in the radar derived wind are discussed. ESA

N92-15489# EISCAT Scientific Association, Kiruna (Sweden).
PLASMA CONVECTION AND AURORAL PRECIPITATION PROCESSES ASSOCIATED WITH THE MAIN IONOSPHERIC TROUGH AT HIGH LATITUDES
P. N. Collis and Ingemar Haeggstroem (Swedish Inst. of Space Physics, Kiruna.) *In* Swedish Inst. for Space Physics, Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technique England Sep. 1990 16 p Repr. from Journal of Atmospheric and Terrestrial Physics (England), v. 50, nos. 4/5, 1988 p 389-404 Previously announced in IAA as A88-44088 Original contains color illustrations (For primary document see N92-15487 06-46)
Avail: NTIS HC/MF A08

Intervals of F region, electron density depletions associated with the main ionospheric trough were studied using latitude scanning experiments with the EISCAT UHF (European Incoherent Scatter Ultra High Frequency) radar. An empirical model predicting the latitude of the trough is proposed. The model is shown to be more appropriate than other available quantitative models for the latitudes covered by EISCAT. It is shown that, within the accuracy of the observations, the relationship between the convection boundary, the trough minimum, and the precipitation boundary is independent of local time and latitude. The relevance of the results is discussed in relation to theoretical models of the F region at high latitudes. ESA

N92-15490# Swedish Inst. of Space Physics, Kiruna. Geophysical Inst.
ION COMPOSITION CHANGES DURING F-REGION DENSITY DEPLETIONS IN THE PRESENCE OF ELECTRIC FIELDS AT AURORAL LATITUDES
Ingemar Haeggstroem and P. N. Collis (EISCAT Scientific Association, Kiruna, Sweden) *In its* Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technique Sep. 1990 28 p Previously announced in IAA as A91-10990 Submitted for publication (For primary document see N92-15487 06-46)
Avail: NTIS HC/MF A08

F region density depletion in the afternoon/evening sector of the auroral zone are studied with the EISCAT UHF (European Incoherent Scatter facility Ultra High Frequency) radar. Four case studies are presented, in which data from three experiment modes are used. Tristatic ion velocity measurements show the development of the poleward electric fields which maximize exactly in the trough minimum. A special analysis technique for incoherent scatter measurements is introduced, based on the ion energy equation. The results from two experiments with accurate velocity measurements indicate that the proportion of O(+) near the F region peak decreased from 100 percent in the undisturbed ionosphere to only 10 and 30 percent respectively in the density minimum of the trough. ESA

N92-15491# EISCAT Scientific Association, Kiruna (Sweden).
HIGH LATITUDE IONOSPHERIC RESPONSE TO A GEOMAGNETIC SUDDEN COMMENCEMENT
P. N. Collis and Ingemar Haeggstroem (Swedish Inst. of Space Physics, Kiruna.) *In* Swedish Inst. for Space Physics, Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technque Sep. 1990 18 p Previously announced in IAA as A91-34466 Submitted for publication (For primary document see N92-15487 06-46)
Avail: NTIS HC/MF A08

A geomagnetic sudden commencement was simultaneous with the onset of a larger scale depletion of F region electron density. Ionosonde measurements from stations south of the radar showed that the density depletion progressed steadily equatorwards by

more than 10 degrees of latitude during the two hours following the impulse. The maximum density depletion occurred about one hour after the magnetic impulse. It is concluded that the main cause of the observed density depletion was sunward transport for lower density nightside plasma following an equartoward expansion of the high latitude plasma convection pattern associated with the magnetic impulse. ESA

N92-15492# Finnish Meteorological Inst., Helsinki. Div. of Geomagnetism.
A NEW MODULATION PRINCIPLE FOR INCOHERENT SCATTER MEASUREMENTS
Markku S. Lehtinen and Ingemar Haeggstroem (Swedish Inst. of Space Physics, Kiruna.) *In* Swedish Inst. for Space Physics, Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technique Washington Sep. 1990 10 p Repr. from Radio Science, v. 22, no. 4, Jul. - Aug. 1987 p 625-634 Previously announced in IAA as A87-48114 Sponsored in cooperation with the Emil Aaltosen Saatio and Jenny ja Antti Wihurin Rahasto Foundations and by the Academy of Finland (For primary document see N92-15487 06-46)
(Paper-7S0166) Avail: NTIS HC/MF A08

A new method for measuring the ionosphere plasma autocorrelation function with an incoherent scatter radar is described. It is shown that this method can be used in similar situations where multipulse methods were previously used . A simple explanation of the method and a precise definition based on ambiguity functions are given. Computational algorithms are discussed. It is shown the present algorithms can be modified in several ways, so that this method can be implemented. ESA

N92-15493# Swedish Inst. of Space Physics, Kiruna.
INCOHERENT SCATTER RADAR MEASUREMENTS OF ION COMPOSITION USING ALTERNATING CODES
Ingemar Haeggstroem, Markku S. Lehtinen, Tauno Turunen, and Matti Vallinkoski (Finnish Meteorological Inst., Helsinki.) *In its* Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technique Sep. 1990 32 p Submitted for publication Sponsored in part by Finnish Meteorological Inst. (For primary document see N92-15487 06-46)
Avail: NTIS HC/MF A08

The design, realization and analysis of alternating code experiments are described. The relative abundance of O(+) is determined by using alternating codes in the EISCAT UHF (European Incoherent Scatter facility Ultra High Frequency) incoherent scatter radar to achieve good spatial and temporal resolution. Theoretical error estimates by statistical inversion theory were applied in the design of the experiment to find out optimal values for the measured lag interval and lag extent in the interesting range of plasma parameters. Good resolution in the composition was achieved by a new post integration method to combine intermediate partial fit residuals to a sufficiently narrow a posteriori distribution in the composition. ESA

N92-15494# Swedish Inst. of Space Physics, Kiruna.
APPLICATION OF ALTERNATING CODES FOR EISCAT OBSERVATIONS DURING THE ERRRIS CAMPAIGN FOR E-REGION PLASMA IRREGULARITIES
Ingemar Haeggstroem, H. Opgenoorth, P. J. S. Williams, G. O. L. Jones, and K. Schlegel (Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany, F.R.) *In its* Incoherent Scatter Studies of Upper Atmosphere Dynamics and Coding Technique Sep. 1990 20 p Previously announced in IAA as A91-10982 Submitted for publication (For primary document see N92-15487 06-46)
Avail: NTIS HC/MF A08

The first operations of an alternating code experiment for high time-resolution measurements are described. It is shown that the improvements of incoherent scatter radar measurements which the alternating code technique provides are substantial, making measurements possible with higher time and/or space resolution than used before. The ERRRIS (E Region Rocket Radar Instability Study) experiment was performed with the existing hardware of EISCAT (European Incoherent Scatter facility) and was necessarily a compromise of scientific demands and system limitations. ESA

N92-15495# California Univ., Berkeley. Lawrence Berkeley Lab.
EARTH SCIENCES DIVISION Annual Report, 1990
Jun. 1991 197 p
(Contract DE-AC03-76SF-00098)
(DE92-000647; LBL-29700) Avail: NTIS HC/MF A09

This Annual Report presents summaries of selected representative research activities grouped according to the principal disciplines of the Earth Sciences Division: Reservoir Engineering and Hydrogeology, Geology and Geochemistry, and Geophysics and Geomechanics. Much of the Division's research deals with the physical and chemical properties and processes in the earth's crust, from the partially saturated, low-temperature near-surface environment to the high-temperature environments characteristic of regions where magmatic-hydrothermal processes are active. Strengths in laboratory and field instrumentation, numerical modeling, and in situ measurement allow study of the transport of mass and heat through geologic media -- studies that now include the appropriate chemical reactions and the hydraulic-mechanical complexities of fractured rock systems. Of particular note are three major Division efforts addressing problems in the discovery and recovery of petroleum, the application of isotope geochemistry to the study of geodynamic processes and earth history, and the development of borehole methods for high-resolution imaging of the subsurface using seismic and electromagnetic waves. In 1989, a major DOE-wide effort was launched in the areas of Environmental Restoration and Waste Management. Many of the methods previously developed for and applied to deeper regions of the earth will, in the coming years, be turned toward process definition and characterization of the very shallow subsurface, where man-induced contaminants now intrude and where remedial action is required. DOE

N92-15496# Academy of Sciences (USSR), Novosibirsk. Inst. Yadernoj Fiziki.
CONTINUOUS TIME REGGE GRAVITY IN THE TETRAD-CONNECTION VARIABLES
V. Khatsymovskij 1990 13 p
(DE91-634037; IYaF-90-1) Avail: NTIS HC/MF A03

The continuous time limit of the tetrad-connection formulation of Regge calculus is found. The shift and lapse functions take on their values loosely. In the continuous space limit the action obtained is reduced to the continuous general relativity action. DOE

N92-15497# Interagency Arctic Research Policy Committee, Washington, DC.
ARCTIC RESEARCH OF THE UNITED STATES, VOLUME 4
Jerry Brown, ed. and Stephen Bowen, ed. (Army Cold Regions Research and Engineering Lab., Hanover, NH.) 1990 124 p
Avail: NTIS HC/MF A06; 2 functional color pages

This is a journal for national and international audiences of government officials, scientists, engineers, educators, Arctic residents, and other people interested in Arctic-related topics. Reports cover a broad spectrum of life in the Arctic including such topics as fish, game, health, social services, science, engineering, environment, oceanography, international activities, international cooperation, global change, conferences, polar libraries, data, policies, research, and history. The emphasis in this issue is on the importance of the Arctic Ocean and its marginal seas to U.S. national interests, including fisheries, the oil and gas industries, and global climate change processes. J.P.S.

N92-15498# Interagency Arctic Research Policy Committee, Washington, DC.
ARCTIC RESEARCH OF THE UNITED STATES, VOLUME 4
Jerry Brown and Stephen Bowen (Army Cold Regions Research and Engineering Lab., Hanover, NH.) 1990 110 p
(NSF-90-151) Avail: NTIS HC/MF A06

This is a journal for national and international audiences of government officials, scientists, engineers, educators, Arctic residents, and other people interested in Arctic-related topics. Reports cover a broad spectrum of life in the Arctic including such topics as fish, game, health, social services, science, engineering, environment, oceanography, international activities, international cooperation, global change, conferences, polar libraries, data, policies, research, and history. The emphasis in this issue is on international activities, including the environment, research ships, and the Bering Sea region's history and resources. J.P.S.

N92-15499# Nuclear Energy Agency, Paris (France).
THE INTERNATIONAL INTRAVAL PROJECT TO STUDY VALIDATION OF GEOSPHERE TRANSPORT MODELS FOR PERFORMANCE ASSESSMENT OF NUCLEAR WASTE DISPOSAL
1990 46 p
(DE91-625105; INIS-XN-306) Avail: NTIS HC/MF A03

INTRAVAL is an international project concerned with the use of mathematical models for predicting the potential transport of radioactive substances in the geosphere. Such models are used to help assess the long term safety of radioactive waste disposal systems. The INTRAVAL project was established to evaluate the validity of these models. Results from a set of selected laboratory and field experiments, as well as studies of occurrences of radioactive substances in nature (natural analogues), are compared in a systematic way with model predictions. Discrepancies between observations and predictions are discussed and analyzed. DOE

N92-15500# International Centre for Theoretical Physics, Trieste (Italy).
PSEUDOPLASTIC DYNAMICAL MODEL OF THE ASTHENOSPHERE AND ITS TECTONIC CONSEQUENCES
S. A. Reju Nov. 1990 7 p
(DE91-633221; IC-90/375) Avail: NTIS HC/MF A02

Recent geophysical investigations show that the asthenosphere is more of a plastic continuum of the earth's interior. Thus Newtonian models are far from depicting the characteristics of motion within the earth's mantle. This paper in particular formulates and analyses pseudoplastic models, especially for a rather vital region of the asthenosphere, namely, the polymorphic region between the lithosphere and the real asthenosphere. DOE

N92-15501# International Centre for Theoretical Physics, Trieste (Italy).
SOME RESULTS ON PSEUDOPLASTIC ROTATION IN THE ASTHENOSPHERE
S. A. Reju Nov. 1990 6 p
(DE91-633222; IC-90/376) Avail: NTIS HC/MF A02

Classical theory of pseudoplasticity allows easy generalization of a two-dimensional model into a three-dimensional case. This is being employed in this paper to arrive at some vital geophysical phenomena within the region between the lithosphere and the asthenosphere. DOE

N92-15502# McDonnell-Douglas Space Systems Co., Huntington Beach, CA.
IMPROVED MODELS OF THE INNER AND OUTER RADIATION BELTS
K. A. Pfitzer Jul. 1991 81 p
(Contract F19628-90-C-0099)
(AD-A242579; PL-TR-91-2187; SR-1) Avail: NTIS HC/MF A05 CSCL 04/1

A pitch angle dependent invariant routine has been developed. This routine written in FORTRAN calculates the first and second invariant for an arbitrary number of pitch angles at any satellite location within the magnetosphere providing the observation is on a closed field line. The invariant routine utilizes a new fast version of the International Geomagnetic Reference Field (IGRF) internal magnetic field and the Olson-Pfitzer 1977 external magnetic field routine. The internal field routine utilizes term dropping at large distances as well as improved coding techniques to obtain speed advantages of 1.5 to 35 over the standard internal field routine. The invariant utilizing routine is highly optimized and calculates all of the pitch angle dependent invariant, utilizing only a single fieldline integral. The invariant routine also determines the actual minimum B value along the line of force and where in local time the field line crosses the magnetic equator. Hiton's expansion of L is used to assign an L value to each of the invariant calculations. GRA

N92-15503# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
[RESEARCH ACTIVITIES OF VARIOUS NORWEGIAN SEISMIC ARRAY STATIONS LOCATED IN THE ARCTIC REGION] Semiannual Report, 1 Oct. 1990 - 31 Mar. 1991
May 1991 173 p
(Contract F08606-89-C-0005)
(AD-A242758) Avail: NTIS HC/MF A08 CSCL 17/10

This summary describes the operation, maintenance and research activities at the Norwegian Seismic Array (NORSAR), the Norwegian Regional Seismic Array (NORESS) and the Arctic Regional Seismic Array (ARCESS). Statistics are given for the period 1 October 1990-31 March 1991. Statistics are also presented for additional seismic stations, which through cooperative agreements with institutions in the host countries provide continuous data to the NORSAR Data Processing Center (NPDC). These stations comprise the Finish Experimental Seismic Array (FINESA), the German Experimental Seismic Array (GERESS), and two 3-component stations in Poland: Ksiaz and Stary Folwark. This report also presents statistics from operation of the Intelligent Monitoring System (IMS). The IMS has been operated in an experimental mode using NORESS and ARCESS data, and the performance has been very satisfactory. GRA

N92-15504*# Princeton Univ., NJ. Plasma Physics Lab.
GENERATION OF FIELD-ALIGNED CURRENT IN THE AURORAL ZONE Final Report
Hideo Okuda 1991 27 p
(Grant NAGw-1606)
(NASA-CR-189036; NAS 1.26:189036) Avail: NTIS HC/MF A03 CSCL 04A

Generation of a magnetic field-aligned current in the auroral zone connecting the magnetospheric and ionospheric plasmas has been studied by means of a three dimensional particle simulation model. The model is of a magnetostatic variety appropriate for a low beta plasma in which the high frequency transverse displacement current has been eliminated. The simulation model is highly elongated along the magnetic field lines in order to model a highly elongated flux tube in the auroral zone. An enhanced field-aligned current was generated by injection of a magnetospheric plasma across the auroral zone magnetic field at the center of the model. Such a plasma injection may correspond to a plasmoid injection at the geomagnetic tail associated with magnetic reconnection during a substorm or a transverse plasma flow along the low latitude magnetopause boundary layer. The results of the simulations show that the field-aligned current can be enhanced over the thermal current by a factor of 5 - 10 via such injection. Associated with the enhanced current are the electrostatic ion cyclotron waves and shear Alfven waves excited in the auroral zone. Author

N92-15505# National Science Foundation, Washington, DC. Div. of Polar Programs.
FACTS ABOUT THE US ANTARCTIC PROGRAM
Jul. 1990 28 p
(NSF-90-88; OMB-3145-0058) Avail: NTIS HC/MF A03 CSCL 08G

A digest is given covering the activities of the U.S. Antarctic Program. Areas covered include program objectives, Federal responsibilities, international aspects, and a brief history of prior U.S. activities. Locations and activities at active year-round stations, summer camps, selected former stations, and transportation and research platforms are given. Author

N92-15506# Los Alamos National Lab., NM.
VARIABILITY OF SURFACE FLUXES OVER A HETEROGENEOUS SEMI-ARID GRASSLAND
F. J. Barnes, W. Porch, D. Cooper, K. E. Kunkel, L. Hipps, and E. Swiatek (Utah State Univ., Logan.) 1991 10 p Presented at the 72d American Meteorological Society Conference, Atlanta, GA, 5-10 Jan. 1992
(Contract W-7405-eng-36)
(DE92-002449; LA-UR-91-3140; CONF-920134-4) Avail: NTIS HC/MF A02

Efforts are increasing throughout the research community to improve the predictive capabilities of general circulation models (GCM's). The US Department of Energy's Atmospheric Radiation Measurement (ARM) program has stated its goals as improving the representation and parameterization of cloud radiative forcing and feedbacks in GCM's by a combined modeling and experimental approach. Along with ambient atmospheric conditions, including advection of water vapor and cloud nuclei from other regions, cloud dynamics depend on surface fluxes of heat and water vapor. The lower boundary of the GCM modeling domain, the earth's surface, exerts a strong influence on regional dynamics of heat and water vapor, and the heterogeneity in the surface features can be responsible for generating regional mesoscale circulation patterns. Changes in the surface vegetation due to anthropogenic activity can cause substantial changes in the ratio of sensible to latent heat flux and result in climate changes that may be irreversible. A broad variety of models for representing energy fluxes are in use, from individual leaf and canopy models to mesoscale atmospheric models and GCM's. Scaling-up a model is likely to result in significant errors, since biophysical responses often have nonlinear dependence on the abiotic environment. Thus, accurate and defensible methods for selecting measurement scales and modeling strategies are needed in the effort to improve GCM's. DOE

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N92-15507# World Meteorological Organization, Geneva (Switzerland).
REPORT OF MEETING OF EXPERTS ON CLIMATE CHANGE DETECTION PROJECT World Climate Data Programme
Nov. 1990 107 p Meeting held in Niagara-on-the-Lake, 26-30 Nov. 1990
(WCDP-13; WMO/TD-418) Avail: NTIS HC/MF A06; print copy available at WMO, Geneva, Switzerland

An account is given of research on climate change detection that was presented at a meeting of experts. Topics covered included climate prediction model validation, the importance of using more remote sensing data in model validations and climate change detection, current modeling activities at the Canadian Climate Center (CCC), the coupling of an upper ocean circulation model to the CCC general circulation model (GCM), the coupling of a version of the Cox-Byran ocean GCM to the CCC GCM, the monitoring of sea surface temperature and salinity at 18 sites around the Canadian coast, a statistical study of the 95 year record of in-situ meteorological data in the northern mid-west of the United States, and the use of proxy data records for climate change detection. Author

N92-15508# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
PRACTICAL WIND SPEED AND RAIN RATE PREDICTION FROM UNDERWATER NOISE Final Report
M. H. Pickett and R. L. Pickett Aug. 1991 32 p Prepared in cooperation with NOAA, Miami, FL
(Proj. 916-40)
(AD-A240990; AD-E040123; NOARL-TN-163) Avail: NTIS HC/MF A03 CSCL 04/2

Equations for estimating wind speed and rain rate from underwater noise are derived in this paper. Data from both this study and other published studies were used. Data for this study were collected during Oct. and Nov. 1988 off south Florida in 50 m of water. Noise levels at 12 frequencies from 0.5 to 30 kHz were recorded, edited and grouped. Regression was used to derive site-specific prediction equations for wind speed and rain rate. The best-fit equations were all linear in sound-pressure level. The best wind-speed predictor, during rain, required both the 2 and 8 kHz frequencies. Data from this study were combined with data from other studies. Regression was used to derive universal prediction equations. These equations were also linear in sound-pressure level. They also required the same predictor frequencies (2 and 8 kHz) as the site-specific equations. However, they were much less accurate, especially for predicting rain rate. For most accurate predictions of wind speed and rain rate from underwater noise, site-specific equations should be derived and used. GRA

N92-15509# Department of the Navy, Washington, DC.
METHOD AND APPARATUS FOR ACOUSTICALLY MEASURING RAINFALL Patent Application
Albert B. Caron, inventor (to Navy) 8 Jul. 1991 17 p
(AD-D015046; US-Patent-Appl-SN-728905) Avail: NTIS HC/MF A03 CSCL 04/2

A method and apparatus are provided for acoustically measuring precipitation rates and total amounts of rainfall. The rainfall is collected in a reservoir and drained through a gravity feed tube system. The gravity feed tube system receives a steady flow of rainfall draining from the reservoir and converts the steady flow into drops by means of surface tension within the tube system. The formed drops exit the tube system and impact a surface that is acoustically responsive to the impact. The acoustically responsive surface is monitored to count the number of drops impacting at the same time, wherein the number of drops counted is indicative of the precipitation rate and total amount of rainfall. GRA

N92-15510# Cologne Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie.
DYNAMIC STRUCTURE ON COLD FRONTS IN MIDDLE EUROPE, ON THE BASIS OF ISENTROPIC NUMERICAL ANALYSES [DYNAMISCHE STRUKTUR VON KALTFRONTEN UEBER MITTELEUROPA AUF DER GRUNDLAGE VON ISENTROPEN NUMERISCHEN ANALYSEN]
Christa Stein 1991 141 p In GERMAN Sponsored by DFG
(Mitt-80; ISSN-0069-5882; ETN-92-90596) Avail: NTIS HC/MF A07

The development of the first three German FRONT EXperiments (FRONTEX) was examined within twenty four hours. Mesoscalar numerical analyses were conducted for the middle European space, in time intervals of six hours, on the basis of radiosonde measurements carried out during FRONTEX. Scalar analyses of the European Center for Medium range Weather Forecast (ECMWF) were used as the first guess. The development of the cold front was examined, using Hoskins Q vector, which describes the frontogenetic action of the geotropic deformation. Several interesting front developments and structures could be examined using this method. ESA

N92-15511# Naval Postgraduate School, Monterey, CA.
MULTISPECTRAL ANALYSIS OF NIGHTTIME LOW CLOUDS OVER THE OCEAN M.S. Thesis
James D. Dykes Mar. 1991 48 p
(AD-A242428) Avail: NTIS HC/MF A03 CSCL 04/2

Multispectral imagery is used for the analysis of nighttime low clouds whose cloud top temperatures are similar to that of the ocean surface. At night AVHRR channel 3 (3.7 microns) and channel 4 (10.8 microns) brightness temperature differences distinguish the presence of low stratus and fog from the ocean surface, improving upon the channel 4 analysis alone. However, the effect of moisture attenuation in channel 4 offsets this temperature difference and impact thresholds which determine low cloud extent. Radiative transfer simulations, using different moisture profiles, helped to determine threshold adjustment. This thesis uses one of two sets of thresholds depending on moisture extent

in an enhancement scheme to discriminate clear areas, and scattered, broken and overcast clouds on different summertime imagery cases over the ocean. Two cases are illustrated thoroughly and the technique was also applied to eight other cases. Results agreed for the most part with surface observations and visible GOES from the previous day. The multi-channel technique improved most or all deficiencies of the single channel analysis in all the cases except one where only some deficiencies were improved. The color enhancement provides a clear, qualitative picture of nighttime low cloud. GRA

N92-15512# Air Force Environmental Technical Applications Center, Scott AFB, IL.
SURFACE OBSERVATION CLIMATIC SUMMARIES FOR WRIGHT-PATTERSON AFB, OHIO
May 1991 368 p
(AD-A242532; USAFETAC/DS-91/245) Avail: NTIS HC/MF A16 CSCL 04/2

Surface observation climatic summaries (SOCS) provide statistical climatic summaries of surface weather observations taken and recorded at specified observing stations. Hourly observations are summarized from a 10-year period of record. GRA

N92-15513# Naval Postgraduate School, Monterey, CA. Dept. of Mathematics.
QUALITY CONTROL OF METEOROLOGICAL OBSERVATIONS Technical Report, Jan. - Jun. 1991
Toke Jayachandran and Richard Franke 16 Sep. 1991 23 p
(AD-A242694; NPS-MA-91-013; NPS-53-91-013) Avail: NTIS HC/MF A03 CSCL 04/2

A test for outliers is discussed and a computer program for its application to meteorological data for purposes of quality control is given. The data for the examples is from the NOARL database of observation minus forecast increments. The program will tag outliers from a group of stations based on daily values over a period of time, mean values over that time period, and standard deviations over that time period. GRA

N92-15872*# Alabama Univ., Huntsville. Dept. of Electrical Engineering.
ADAPTIVE OPTICS IN COHERENT LIDAR WIND MEASUREMENTS: A FEASIBILITY STUDY
Robert P. Leland *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 04B

N92-15896*# Chicago State Univ., IL. Dept. of Mathematics and Computer Science.
TRANSPORT OF PHOTONS PRODUCED BY LIGHTNING IN CLOUDS
Richard Solakiewicz *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N92-15514*# National Aeronautics and Space Administration, Washington, DC.
GLOBEC (GLOBAL OCEAN ECOSYSTEMS DYNAMICS): NORTHWEST ATLANTIC PROGRAM GLOBEC Report No. 2
Feb. 1991 113 p Presented at the GLOBEC Canada/US Meeting on NW Atlantic Fisheries and Climate, Dartmouth, Nova Scotia, 19-21 Jun. 1990 Prepared in cooperation with Joint Oceanographic Inst., Inc., Washington, DC
(NASA-TM-105122; NAS 1.15:105122) Avail: NTIS HC/MF A06 CSCL 08C

The specific objective of the meeting was to plan an experiment in the Northwestern Atlantic to study the marine ecosystem and its role, together with that of climate and physical dynamics, in determining fisheries recruitment. The underlying focus of the GLOBEC initiative is to understand the marine ecosystem as it related to marine living resources and to understand how fluctuation in these resources are driven by climate change and exploitation. In this sense the goal is a solid scientific program to provide basic information concerning major fisheries stocks and the environment that sustains them. The plan is to attempt to reach this understanding through a multidisciplinary program that brings to bear new techniques as disparate as numerical fluid dynamic models of ocean circulation, molecular biology and modern acoustic imaging. The effort will also make use of the massive historical data sets on fisheries and the state of the climate in a coordinated manner. Author

N92-15515# Beleidscommissie Remote Sensing, Delft (Netherlands).
BATHYMETRY IN INDONESIAN COASTAL WATERS: A FIRST PILOT STUDY
G. H. F. M. Hesselmans (Delft Hydraulics Lab., Netherlands) Feb. 1991 47 p
(BCRS-90-26; ETN-92-90433) Avail: NTIS HC/MF A03

A method to extract bathymetric information from Indonesian coastal waters by using satellite remote sensing methods is considered. The bathymetry estimation technique uses satellite imagery in the visible part of the electromagnetic spectrum. The algorithm uses the tool flow transfer model. Spatial variability of water and bottom composition is taken into account. The potential users of this technique are discussed and the theoretical bases are presented. The satellite imagery and calibration data are discussed, results of the analysis are presented and the technical feasibility are treated. The contents of the training course is given, and its appreciation by the participants is evaluated. Conclusions of this study and recommendation for a continuation of this project are given. ESA

N92-15516# Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
MODELLING AND PREDICTION OF REGIONS OF THE NORTH PACIFIC Final Report
Allan R. Robinson 8 Aug. 1991 11 p
(Contract N00014-87-K-6009)
(AD-A242424) Avail: NTIS HC/MF A03 CSCL 08/3

This was a project for the identification and description of the phenomenology and research into the development of a nowcast and forecast scheme for the frontal location and predominant features of the sub-arctic frontal region of the North Pacific Ocean. The potential coupling of the Harvard Open Ocean Model (HOOM) to a regional ocean model was investigated. GRA

N92-15517# Washington Univ., Seattle. Applied Physics Lab.
CTD, XBT, AND XSV DATA FROM THE GREENLAND SEA: R/V KNORR CRUISE 8809 (6 SEPTEMBER - 4 OCTOBER 1988) AND R/V ENDEAVOR CRUISE EN200 (3 AUGUST - 10 SEPTEMBER 1989). DEPARTMENT OF STATE CRUISES 88-18 AND 88-120 Final Report, Sep. 1988 - Sep. 1989
C. M. Bader, B. M. Howe, J. A. Mercer, P. F. Worcester, B. D. Cornuelle, and J. Lynch Oct. 1991 122 p
(Contract N00014-87-K-0760)
(AD-A242435; APL-UW-TM-3-91) Avail: NTIS HC/MF A06 CSCL 08/3

The profile data presented in this report were taken in support of two projects. The goals of the first, the Greenland Sea Project (GSP) tomography experiment, were: (1) to study the processes that occur during convection and ventilation of the deep waters in the Greenland Sea; and (2) to study the dynamics of the wind-driven Greenland Sea gyre. The goals of the Moving Ship Tomography (MST) project are: (1) to determine the precision with which the

ocean mesoscale sound speed field can be measured by moving ship tomography; and (2) to study mesoscale eddy kinematics and dynamics. The MST project made use of the acoustic sources installed for GSP to perform engineering tests. The acoustic moorings were installed, and deep CTD stations were occupied during the cruise in September 1988. During the last eight days of the cruise, MST test were conducted. XBT and/or XSV measurements (760 and 850 m, respectively) were made at approximately 13 km spacing along all but 3 of the 15 transmissions paths between the transceiver moorings. The MST89 cruise dates of 3 to 16 August 1989 encompassed Leg 1 of En200. A CTD profile was taken to a depth of 135 m (the base of the deployed acoustic arrays) at each of the 54 acoustic stations. Five sections were made with XBTs deployed every 6 km and an XSV deployed every 30 km. Six deep CTD stations were occupied during Leg 3, from 5 to 10 September. GRA

N92-15518# Naval Postgraduate School, Monterey, CA.
ACOUSTIC MODELING OF THE MONTEREY BAY TOMOGRAPHY EXPERIMENT M.S. Thesis
Donald F. Smith Dec. 1990 66 p
(AD-A242658) Avail: NTIS HC/MF A04 CSCL 08/2

In December 1988, a tomographic signal transmission test was conducted in order to test the feasibility of tomographic analysis in a region of complex bathymetry. The transmission test was conducted in the Monterey Bay where the signals propagated from deep water to shallow, continental shelf water. In order to use the inverse techniques to infer the ocean processes affecting the acoustic propagation, the propagation paths of the tomographic signal between the transmitter and receivers must be determined. This thesis demonstrates that the forward problem of arrival path identification in the complex propagation environment of the Monterey Bay can be solved by using high resolution bottom bathymetry along with an appropriate sound speed profile as input to a three dimensional Hamiltonian raytracing program, HARPO. The eigenrays found using this technique matched the travel times and relative amplitudes of the measured multipath arrivals. GRA

N92-15519# Naval Postgraduate School, Monterey, CA.
MESOSCALE VARIABILITY OF THE CARIBBEAN SEA FROM GEOSAT M.S. Thesis
Carlos A. Amaya Mar. 1991 66 p
(AD-A242711) Avail: NTIS HC/MF A04 CSCL 04/2

Two years of GEOSAT Exact Repeat Mission (ERM) altimetry and wind speed measurements in the Caribbean Sea are used to determine the sea surface height mesoscale variability and to characterize the wind stress field during 1987-88. The alongtrack sea surface anomalies are determined using along track derivatives for estimation of the mean sea surface height, and a least square fit is used to remove the orbital error. Biased points near land were removed and high frequency noise was filtered by using a 70 km spatial running mean. Contours of sea surface height anomalies made by every ERM period detected the formation and evolution of two anticyclonic eddies formed during 'non-windy' tropical season, one each year, with a height signature that reached + 30 cm. No eddies related to the Caribbean Current were apparent during the other seasons. A quasi-permanent cyclonic eddy was detected near the San Andreas Archipelago, confirming model predictions. Seasonal wind speed derived from GEOSTAT data agrees with previous studies in the area. The relaxation of the wind after the windy season and the strong meridional wind gradient in the center of the Caribbean coincide with the formation of the anticyclones. This suggests that the wind field influences eddy formation. Anomalies in the averaged wind field were produced by strong synoptic events (hurricanes) which are biased due to the 17 day sampling character of the GEOSAT data. GRA

N92-15520# Tracor Sciences and Systems, San Diego, CA.
STUDIES OF OCEAN VOLUME REVERBERATION AT HIGH ACOUSTIC FREQUENCIES Final Report
D. V. Holliday 8 Oct. 1991 23 p
(Contract N00014-81-C-0562)
(AD-A242719; T-91-06-0039-U) Avail: NTIS HC/MF A03 CSCL 17/1

The principal goal of this research was to improve the ability of oceanographers to quantitatively measure small-to-intermediate scale spatial and temporal distributions of marine zooplankton, with size discrimination, in relation to the distribution of physical and chemical features in the ocean environment. The research resulted in the development of an new technology based on the scattering of high frequency underwater sound at multiple frequencies from zooplankton and micronekton. The technology allows one to examine distributions of small zooplankton, by size, in relation to ocean physics and chemistry, in situ and essentially in real time. The most sophisticated implementation of this technology is the Multi-frequency Acoustic Profiling System (MAPS). During the course of this work, it was used in numerous research programs that were focused on different aspects of the ecology of marine zooplankton. It was used in support of programs, in a wide range of ocean environment, including the California Current, the Coastal Transition Zone (off northern California), the Gulf Stream core, a frontal zone near Cape Hatteras, a frontal zone near Cape Canaveral, slope water of the North Atlantic (north of a meander in the Gulf Stream) and at several locations in the Irish Sea. GRA

N92-15521# Texas Univ., Austin. Applied Research Lab.
SPATIAL AND TEMPORAL PROPERTIES OF THE NOISE FIELD OBSERVED IN TAGEX 87
Clark S. Penrod and David E. Grant 1 Nov. 1990 70 p
(Contracts N00024-86-C-6134; N00039-88-C-0043)
(AD-A242730; ARL-TR-90-37) Avail: NTIS HC/MF A04 CSCL 20/1

This report presents an analysis of the vertical spatial structure of the near-bottom ambient noise field at a western Atlantic site, based on recorded data from a 24-element vertical line array. The properties of the noise field are discussed in terms of dominant sources and propagation mechanisms. Particular emphasis is placed on the effects of local and distant shipping on beam noise levels for a vertical array. GRA

51 LIFE SCIENCES (GENERAL)

N92-15522# International Centre for Theoretical Physics, Trieste (Italy).
ON CORRELATIONS OF NEURONAL SPIKE DISCHARGES
S. I. Doguwa Oct. 1990 19 p
(DE91-625187; IC-90/292) Avail: NTIS HC/MF A03

To assess the dependence structure in two simultaneously occurring stationary spike trains A and B, the cross intensity function, C(sub f)(t) and the pair correlation function g(t) can be very useful. Doss (1989) provides an estimate of C(sub f)(t) at a finite number of points. However, this estimator does not take into consideration the bounded nature of the sampling interval (beta). Two new boundary corrected estimators are proposed. These two estimators have a much smaller bias and mean squared error than the existing alternative. The spike discharges recorded simultaneously from a pair of auditory nerve fibers are analyzed using the new estimators. DOE

N92-15523# International Centre for Theoretical Physics, Trieste (Italy).
FLUCTUATION IN TISSUE TEMPERATURE DUE TO ENVIRONMENTAL VARIATION. PART 1: EFFECT OF FREE CONVECTION CURRENTS
A. R. Bestman Dec. 1990 11 p
(DE91-641475; IC-90/470) Avail: NTIS HC/MF A03

Naturally when there is heat transfer between the environment and a vertical tissue, free convection currents arise and these currents provoke fluid motion. This problem is solved in this paper for the transient situation when there is a step change in the

environmental temperature for the idealized situation of a single tissue. The Laplace transform technique does not allow an analytic inversion. However, for limiting values of the film heat transfer coefficient, analytical solutions are obtained. This work compliments previous ones where tissue is assumed horizontal and free convection currents are ignored. DOE

N92-15524# International Centre for Theoretical Physics, Trieste (Italy).
FLUCTUATION IN TISSUE TEMPERATURE DUE TO ENVIRONMENTAL VARIATION. PART 2: EFFECT OF BODY THERMAL RADIATION
A. R. Bestman Dec. 1990 7 p
(DE91-641476; IC-90/471) Avail: NTIS HC/MF A02

When the body temperature is very high, there is the need to incorporate thermal radiation in the bioheat equation. This problem is modelled and solved when there is a small step rise in the environmental temperature. Employing the Laplace transform and the WKB approximation asymptotic solutions are obtained for limiting values of the skin film coefficients. These analytical solutions are discussed quantitatively. DOE

N92-15525# International Centre for Theoretical Physics, Trieste (Italy).
FLUCTUATION IN TISSUE TEMPERATURE DUE TO ENVIRONMENTAL VARIATION. PART 3: EFFECT OF EXTERNAL THERMAL RADIATION
A. R. Bestman Dec. 1990 8 p
(DE91-641477; IC-90/472) Avail: NTIS HC/MF A02

In this paper thermal radiative heat transfer is considered when there is heat exchange between very hot environment and the skin. The Laplace transform method coupled with limiting values of the film heat transfer coefficients yield analytical solutions for the perturbed temperature equations. The analytical results are discussed. DOE

N92-15526# California Univ., Berkeley. Lawrence Berkeley Lab.
LIFE SCIENCES
L. Day, ed. Apr. 1991 95 p
(Contract DE-AC03-76SF-00098)
(DE92-000642; LBL-30557) Avail: NTIS HC/MF A05

This document is the 1989-1990 Annual Report for the Life Sciences Divisions of the University of California/Lawrence Berkeley Laboratory. Specific progress reports are included for the Cell and Molecular Biology Division, the Research Medicine and Radiation Biophysics Division (including the Advanced Light Source Life Sciences Center), and the Chemical Biodynamics Division. DOE

N92-15527# Trinity Univ., San Antonio, TX. Radiation Bioeffects Center.
DEFINITION OF PROCEDURES FOR CHRONIC EXPOSURE OF CANCER-PRONE MICE TO LOW-LEVEL 2,450-MHz RADIO-FREQUENCY RADIATION Final Report, Jan. - Apr. 1991
Melvin R. Frei and James H. Merritt Sep. 1991 21 p
(Contract F33615-87-D-0627)
(AD-A242438; AL-TR-1991-0077) Avail: NTIS HC/MF A03
CSCL 06/5

Several published reports have implied that long-term, low-level exposure to radio-frequency radiation (RFR) may influence the growth and/or differentiation of mammalian cells in vivo. Specifically, the issue involves whether or not such RFR exposure can cause cells to differentiate into an invasive form (tumor induction) or can act as a promoter of tumor expression. To address this issue, the United States Air Force sponsors a project involving long-term exposure of tumor-prone mice to low-level 435-MHz RFR. An earlier onset, greater incidence, or faster growth rate of tumors in the irradiated group, as compared to sham irradiated controls, would suggest an enhanced tumor promotion potential. This investigation is essentially a parallel study to that being conducted at 435 MHz. The critical difference is the exposure frequency; this study will be conducted at 2,450 MHz, which is near the resonant frequency for mice. Knowledge gained from this study will contribute to the ongoing evaluation of safety standards for human exposure to RFR which is essential to the protection of military operational personnel and the general public. GRA

N92-15528# Texas Univ., San Antonio. Div. of Life Sciences.
EFFECTS OF MICROWAVE RADIATION ON NEURONAL ACTIVITY Final Report, 1 Sep. 1989 - 31 Jan. 1991
Deborah L. Armstrong, John B. Denny, Patrick Nash, and Sveta Singh Oct. 1991 18 p
(Contract F33615-87-D-0626; AF Proj. 2312)
(AD-A242515; AL-TR-1991-0069) Avail: NTIS HC/MF A03
CSCL 20/5

A microwave radiation device was designed and constructed for exposure of fetal rat neurons during microscopic observation. The device exposed growing neurons to 400 MHz radiation amplitude modulated at 16 Hz. Continuous exposure to radio-frequency radiation for 4 consecutive days led to the development of cell number density gradient. The greater number of cells occurred in the center of the culture plate which was directly in the field as opposed to the more peripheral areas of the plate which were outside of the field. Nonirradiated control cultures did not display this gradient. This finding was replicated under various exposure periods. The gradient was formed within 20 min of placing the plates on the antenna. GRA

N92-15529# Texas Univ., El Paso.
THE EFFECTS OF PRALIDOXIME, ATROPINE, AND PYRIDOSTIGMINE ON THERMOREGULATION AND WORK TOLERANCE IN THE PATAS MONKEY Final Report, Jan. 1989 - Dec. 1990
Reynaldo S. Elizondo Oct. 1991 20 p
(Contract F33615-87-D-0627)
(AD-A242556; AL-TR-1991-0067) Avail: NTIS HC/MF A03
CSCL 06/5

A continuous flow indirect calorimetry system was used to continuously measure metabolic rates in patas monkeys at rest or during exercise when exposed to ambient temperatures of 25 or 35 C. The exercise system was also used to evaluate the effects of pralidoxime, atropine, and/or pyridostigmine on the exercise tolerance time in primates. Rectal temperature and heart rate were continuously monitored by a telemetry system while total evaporative water loss was estimated from weight differences before and after exercise. Resting metabolic rates measured at 35 C were significantly higher than at 25 C and averaged 73.3 and 49.1 W.m2 respectively. No significant difference was observed in the exercising metabolic rates of the patas monkey measured at 25 C which averaged 126.3 and that at 35 C which averaged 123.4 W/m2. No significant drug effects on metabolic rate or respiratory quotient were observed. Pyridostigmine treatment was associated with an increase in exercise time, a lower rectal temperature, heart rate, and a 40 percent increase in water loss. Atropine treatment produced a decrease in exercise time of 61 min and water loss, and an increase in heart rate. Pralidoximine treatment alone or in combination with atropine had no significant effect on exercise time or thermoregulation. Pyridostigmine treatment in combination with atropine resulted in a significant increase in exercise time and a 47 percent increase in water loss when compared to atropine treatment alone. GRA

N92-15530# Trinity Univ., San Antonio, TX.
LATE IMMUNOBIOLOGICAL EFFECTS OF SPACE RADIATION Final Report, Feb. - Dec. 1989
William H. Stone and Michael L. Miller Dec. 1990 29 p
(Contract F33615-87-D-0626)
(AD-A242590; USAFSAM-TR-90-39) Avail: NTIS HC/MF A03
CSCL 06/5

The objective of this investigation was to obtain profiles of immune competence in primates more than 25 years following exposures to protons. The availability of irradiated animals provided a unique opportunity to study immune defects which could be relevant to astronauts and high flying pilots. The Delayed Radiation

Effects Colony at Brooks Air Force Base provided blood samples. Antibody mediated immune function (associated with B-cell function) was assessed by measuring immunoglobulin levels, hemolytic complement activity and autoantibodies; cell mediated immune function (associated with T-cell function) was evaluated by measuring selected T and B cell activity plus response to mitogens and interleukin production. There were no significant differences between control and irradiated animals for most parameters measured in this preliminary survey, but lymphocyte proliferation tended to decrease as radiation dosage increased. Survivors of low and intermediate doses of proton irradiation apparently show few late immunobiological effects, which is encouraging. Additional monkeys will be measured in future confirmatory studies. GRA

N92-15531# California Univ., Santa Barbara. Marine Science Inst.
THE GENETIC BASIS OF SPECIFICITY IN DINOFLAGELLATE-INVERTEBRATE SYMBIOSIS Final Report, 1 Jul. 1988 - 30 Sep. 1991
Robert K. Trench 30 Sep. 1991 4 p
(Contract N00014-88-K-0463)
(AD-A242631) Avail: NTIS HC/MF A01 CSCL 06/1

The prime goals of this award were: (1) to study the composition of the cell walls of symbiotic dinoflagellates; (2) analyze the chemical composition of the glycoproteins exuded by symbiotic dinoflagellates; and (3) sequence the SSU rRNA gene from the symbiotic dinoflagellate Symbiodinium pilosum and assess its phylogenetic position relative to other protists. All three of these goals have been accomplished, and manuscripts or published papers describing the observations are attached. Briefly, the cell walls of symbiotic dino-flagellates are composed of cellulose and proteins, but whether any of the proteins are involved in recognition of symbionts by hosts remains unresolved. The large molecular weight glycoproteins exuded by symbiotic dinoflagellates have been characterized, and polyclonal antibodies have been prepared against them. We have preliminary evidence that show that the glycoproteins excuded by the symbionts in culture are also exuded in hospite. Analyses of the SSU rRNA sequence of S. pilosum shows that it is clustered among the dinoflagellates which appear to share a common ancestry with the Apicomplexa and the Ciliata. GRA

N92-15532# California Univ., Santa Barbara. Marine Science Inst.
MOLECULAR MECHANISMS OF CHEMOSENSORY RECEPTORS, SIGNAL TRANSDUCERS, AND THE ACTIVATION OF GENE EXPRESSION CONTROLLING ESTABLISHMENT OF A MARINE SYMBIOSIS Final Technical Report, 1 Aug. 1987 - 31 Oct. 1990
Daniel E. Morse 31 Oct. 1990 6 p
(Contract N00014-87-K-0762)
(AD-A242729) Avail: NTIS HC/MF A02 CSCL 06/1

The objectives of this research were (1) to characterize the molecular mechanisms by which marine invertebrate larval chemosensory receptors and their associated signal transducers regulate surface attachment and metamorphosis of the larvae in response to chemical signals from the environment; and (2) to characterize the molecular mechanisms regulating the activation of specific gene expression in the developmentally arrested marine invertebrate larva, in response to chemical inducers of metamorphosis. We have found that metamorphosis in larvae of the marine mollusc, Haliotis rufescens (red abalone), is controlled by exogenous chemical signals recognized and transduced by two convergent chemosensory pathways: a morphogenetic pathway activated by a GABA mimetic peptide morphogen encountered by the larvae on surfaces of recruiting (host) algae, and a regulatory pathway stimulated by lysine in seawater. The system displays both habituation, acting at the level of the morphogenetic pathway receptors and facilitation, mediated by the regulatory pathway. Output and sensitivity of the morphogenetic pathway are amplified as much as 100-fold by stimulation of the regulatory pathway. GRA

N92-15533*# Research Triangle Inst., Research Triangle Park, NC.
ENGINEERING DERIVATIVES FROM BIOLOGICAL SYSTEMS FOR ADVANCED AEROSPACE APPLICATIONS
Daniel L. Winfield, Dean H. Hering, and David Cole Dec. 1991 288 p Original contains color illustrations
(Contract NAS2-13119)
(NASA-CR-177594; A-92016; NAS 1.26:177594) Avail: NTIS HC/MF A13; 6 functional color pages CSCL 06C

The present study consisted of a literature survey, a survey of researchers, and a workshop on bionics. These tasks produced an extensive annotated bibliography of bionics research (282 citations), a directory of bionics researchers, and a workshop report on specific bionics research topics applicable to space technology. These deliverables are included as Appendix A, Appendix B, and Section 5.0, respectively. To provide organization to this highly interdisciplinary field and to serve as a guide for interested researchers, we have also prepared a taxonomy or classification of the various subelements of natural engineering systems. Finally, we have synthesized the results of the various components of this study into a discussion of the most promising opportunities for accelerated research, seeking solutions which apply engineering principles from natural systems to advanced aerospace problems. A discussion of opportunities within the areas of materials, structures, sensors, information processing, robotics, autonomous systems, life support systems, and aeronautics is given. Following the conclusions are six discipline summaries that highlight the potential benefits of research in these areas for NASA's space technology programs. Author

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N92-15534# Massachusetts General Hospital, Boston. Physics Research Lab.
NEW IMAGING SYSTEMS IN NUCLEAR MEDICINE
1991 7 p
(Contract DE-FG02-87ER-60519)
(DE92-000786; DOE/ER-60519/T3) Avail: NTIS HC/MF A02

We continue to use and maintain PCR-I, the single-slice high-resolution high-sensitivity positron emission tomograph, while development proceeds on PCR-II, a three-dimensional Positron Emission Tomography (PET) system. A two-dimensional bismuth germanate (BGO) scintillation detector has been designed and we are nearing completion of the detector, including the light guide, crystals and phototube assembly, and the gantry electronics. We are currently exploring techniques for a very high resolution (sub-mm) PET imaging system. We are using the current PCR-I system to assess changes in presynaptic dopamine receptors and glucose utilization in current biological models of Huntington's disease. Our preliminary studies support the use of the primate (Cynomolgus monkey) model of Huntington's disease to monitor in vivo functional changes. We are planning to extend this study to examine the MPTP model of Parkinson disease, and to assess the therapeutic value of D(sub 1) dopamine receptor agonists for treatment of (MPTP) induced neurological defects. DOE

N92-15535# SRI International Corp., Menlo Park, CA.
DEVELOPMENT OF A THERAPEUTIC AGENT FOR WOUND-HEALING ENHANCEMENT Quarterly Report No. 2
Amrit K. Judd Sep. 1991 10 p
(Contract N00014-91-C-0066)
(AD-A242529) Avail: NTIS HC/MF A02 CSCL 06/5

During this quarter, we synthesized and purified three peptides, one from PDGF A-chain sequence and two from PDGF B-chain sequence. We also conducted cell binding experiments and assays for mitogenesis. Competitive receptor binding assays were performed on four peptides using NIH 3T3 cells. None of the peptides tested so far showed any binding. We tested two peptides

at three doses and two at four doses. In the future, we will test peptides initially at three doses. Active peptides will be tested at four or more doses. GRA

N92-15536# Missouri Univ., Kansas City.
GLYCYL-L-GLUTAMINE: A DIPEPTIDE NEUROTRANSMITTER DERIVED FROM BETA-ENDORPHIN Midterm Report, 3 Jan. 1990 - 31 Aug. 1991
William R. Millington 1 Sep. 1991 36 p
(Contract DAMD17-90-Z-0022; DA Proj. 3M1-61102-BS-12)
(AD-A242587) Avail: NTIS HC/MF A03 CSCL 06/5

The objective of this research is to test the hypothesis that glycyl-L-glutamine, a dipeptide synthesized through the post-translational processing of Beta-endorphin, acts as a neurotransmitter in the brain and a circulating hormone in the periphery. To test this hypothesis, we established three working objectives: (1) to evaluate the physiological responses produced by glycyl L glutamine and test whether it modulates the opiate actions of Beta-endorphin; (2) to examine its distribution in the brain and pituitary and determine whether it is specifically co-localized with Beta-endorphin; (3) to characterize the receptors which mediate glycyl L glutamine's pharmacologic effects. During the current project period, we found that glycyl L glutamine produces three markedly different pharmacologic responses: it stimulates a trophic response in cardiac myocytes, inducing expression of the asymmetric form of acetylcholinesterase, a classical marker for synaptic innervation; and it produces neuroimmune regulatory effects in T lymphocytes, enhancing c-myc oncogene expression. GRA

N92-15537# Naval Submarine Medical Research Lab., Groton, CT.
A CLINICAL TRIAL OF A COMPUTER DIAGNOSIS PROGRAM FOR CHEST PAIN Interim Report
S. M. Luria, David G. Southerland, and Douglas M. Stetson 7 Dec. 1990 15 p
(AD-A242795; NSMRL-1162) Avail: NTIS HC/MF A03 CSCL 15/6

We evaluated the performance of a computer program designed to assist corpsmen in managing patients who are present at sea with chest pain. The diagnostic accuracy of the program for three common and serious causes of chest pain (myocardial infarction (MI), angina, chest infection) as well as its accuracy for nonspecific chest pain, was compared with that of emergency room physicians at three Naval hospitals for 132 patients. The percentage of correct diagnoses by the computer program (72 pct.) was not significantly different from that of the physicians (79 pct.), although the accuracy of the physicians was better. The computer program was able to distinguish MI from the other diseases as well as the physicians (i.e., was as sensitive, 83 vs. 84 pct.) and at the same time made fewer false diagnoses of MI (i.e., was more specific). The computer's ability to distinguish among cardiac illnesses was not as good as that of the physicians and it misdiagnosed more cases of angina. The computer program is suitable for use by medical personnel practicing in isolated locations and may help improve diagnostic accuracy in cases of MI. Its failures emphasize that it cannot substitute for medical personnel, but can be helpful to medical personnel when a patient's diagnosis is uncertain. GRA

N92-15538* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 356)
Dec. 1991 71 p
(NASA-SP-7011(356); NAS 1.21:7011(356)) Avail: NTIS HC A04; NTIS standing order as PB91-912300, $15.00 domestic, $30.00 foreign CSCL 06E

This bibliography lists 192 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during November 1991. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

N92-15868*# Alabama A & M Univ., Huntsville. Food Science and Animal Industries.
BIOLOGICAL PATTERNS: NOVEL INDICATORS FOR PHARMACOLOGICAL ASSAYS
Jacqueline U. Johnson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 3 p (For primary document see N92-15850 06-80)
(Grant NGT-01-002-099)
Avail: NTIS HC/MF A12 CSCL 06C

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N92-15539# Dartmouth Coll., Hanover, NH. Dept. of Psychology.
MULTIMODAL INTERACTIONS IN SENSORY-MOTOR PROCESSING Annual Technical Report, Jul. 1990 - Jul. 1991
Patricia A. Reuter-Lorenz, H. C. Hughes, Robert Fendrich, G. Nozawa, and M. S. Gazzaniga 30 Aug. 1991 108 p
(Grant AF-AFOSR-0437-89)
(AD-A242511; AFOSR-91-0762TR) Avail: NTIS HC/MF A06 CSCL 06/5

We describe our progress in: (1) delineating the functional architecture of the human saccadic and attentional orienting systems (section 2) based on analyses of reaction times; and (2) development of accurate surface maps of the human neocortex in vivo from reconstructions of MR scans (section 3). Work carried out under AFOSR funding (2 in 90-91 year) provides the basis for our current model, which identifies two serially organized component processes in saccade generation (section 1.1). The early component is sensory; it's most noteworthy feature being the mode of convergence of visual and auditory information in the saccadic control system (section 1.2). In the subsequent pre-motor component, the processing time is partially determined by the state of fixation. Fixation point offsets facilitate saccade latencies by decreasing premotor processing times via disinhibition. These sensory and motor facilitatory mechanisms can be combined to optimize human saccadic performance (section 1.1). The ultimate goal is to provide a model which accounts for human oculomotor performance in terms of physiologically plausible component subprocesses. GRA

N92-15540# Air Force Human Resources Lab., Brooks AFB, TX.
THE ANALYTIC ONION: EXAMINING TRAINING ISSUES FROM DIFFERENT LEVELS OF ANALYSIS Interim Paper, Jul. 1989 - Jun. 1991
Theodore A. Lamb and Keric B. Chin Sep. 1991 29 p
(AF Proj. 1121)
(AD-A242523; AL-TP-1991-0033) Avail: NTIS HC/MF A03 CSCL 05/6

The layers found in an average grocery store onion, perhaps of the sweet Vidalia variety, are used as an analog for levels of conceptual analysis. This paper focuses on applying the 'Analytic Onion' to training issues. The core of the analytic onion is the biological level, surrounded by the individual, the group, the organizational, community, societal, world system, and space system levels of analysis. Each level of analysis is discussed in the paper as well as the interactions between the levels. Disciplinary perspectives from biology, psychology, social psychology, political science, and sociology are presented. All of these disciplines are viewed as having contributions to make the examination of training issues when the focus is on the appropriate level of analysis. This paper presents these varied perspectives in unitary fashion and argues that using a single disciplinary perspective may result in missing many alternative training solutions to operational

problems or solutions to training and operational problems which do not appear at first glance to be related to training or operations. GRA

N92-15541# Federal Aviation Administration, Cambridge, MA.
ANALYSIS OF PILOT RESPONSE TIME TO TIME-CRITICAL AIR TRAFFIC CONTROL CALLS Final Report, Jul. 1990 - Jun. 1991
Kim M. Cardosi and Pamela W. Boole Aug. 1991 19 p
(AD-A242527; DOTVNTSC-FAA-91-12; DOT/FAA/RD-91/20)
Avail: NTIS HC/MF A03 CSCL 05/9

One of the most important time-critical air traffic control messages for a pilot is one that required an immediate maneuver for traffic avoidance. This study examines the time required for air traffic controllers to successfully transmit such a message in the en route environment as measured from the beginning of the controller's message to the end of the pilot's correct acknowledgement. This total time is broken down into its component parts: the duration of the controller's message, the time between the end of the controller's message and the beginning of the pilot's response, and the duration of the pilot's acknowledgement. For comparison purposes, transmissions relaying clearances for turns for reasons other than traffic and traffic advisories were also examined. GRA

N92-15542# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
EARLY TRAINING STRATEGY DEVELOPMENT FOR INDIVIDUAL AND COLLECTIVE TRAINING Final Report, Oct. 1989 - Aug. 1990
Larry L. Meliza and Bruce W. Knerr Aug. 1991 47 p
(AD-A242753; ARI-TR-936) Avail: NTIS HC/MF A03 CSCL 05/6

The training strategy for a new weapon system identifies the training devices required, the tasks each device will be used to train, and the circumstances under which each device will be employed. Consideration of embedded training (i.e., use of operational equipment and training software to provide training) as the first option for new weapon systems forces early development of training strategies. Training development tools, such as the Optimization of Simulation-Based Training System, are available to support development of a training strategy, but an overall model is needed to show how the various tools can be integrated to support strategy development. This report describes a high-level model for early training estimation that incorporates other training development tools. The benefits of this model include integration of individual skills training across duty positions, individual skills training with collective training, collective task training across unit missions, and collective task training across echelons. GRA

N92-15543# Westinghouse Hanford Co., Richland, WA.
SITUATIONAL SIMULATIONS IN INTERACTIVE VIDEO
L. J. Smith Jul. 1991 5 p Presented at the Interactive Videodisc in Education and Training, Arlington, VA, 21-23 Aug. 1991
(Contract DE-AC06-87RL-10930)
(DE92-002113; WHC-SA-1290; CONF-9108176-1) Avail: NTIS HC/MF A01

The Westinghouse Hanford Company Advanced Training Technologies section is using situational simulations in several interactive video training courses. Two applications of situational simulations will be discussed. In the first, used in the Hanford General Employee Training course, the student evaluates employee's actions in simulations of possible workplace situations. In the second, used in the Criticality Safety course, students must follow well-defined procedures to complete tasks. Design and incorporation of situational simulations will be discussed. DOE

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N92-15544# Joint Food and Agriculture Organization - International Atomic Energy Agency, Vienna (Austria).
ANALYTICAL DETECTION METHODS FOR IRRADIATED FOODS
Mar. 1991 172 p
(DE91-625550; IAEA-TECDOC-587) Avail: NTIS HC/MF A08

The present publication is a review of scientific literature on the analytical identification of foods treated with ionizing radiation and the quantitative determination of absorbed dose of radiation. Because of the extremely low level of chemical changes resulting from irradiation or because of the lack of specificity to irradiation of any chemical changes, a few methods of quantitative determination of absorbed dose have shown promise until now. On the other hand, the present review has identified several possible methods, which could be used, following further research and testing, for the identification of irradiated foods. An IAEA Co-ordinated Research Programme on Analytical Detection Methods for Irradiation Treatment of Food ('ADMIT'), established in 1990, is currently investigating many of the methods cited in the present document. DOE

N92-15545# Bolt, Beranek, and Newman, Inc., Cambridge, MA.
INTERFACE DESIGN TOOLS PROJECT Final Report, Jan. 1989 - May 1990
William J. Salter, Dan Cerys, Bruce Papazian, and R. B. Roberts Aug. 1991 13 p
(Contract F30602-87-D-0093)
(AD-A242581; BBN-7562; RL-TR-91-177) Avail: NTIS HC/MF A03 CSCL 23/2

This report describes an effort to provide tools that assist in the design and development of user interfaces. Human factors knowledge is used to provide an intelligent capability which can be applied to generate interface alternatives and the underlying code for those alternatives. Two gaps evident in available tools for dealing with windows were also addressed: clustering windows and linking windows. Clustering deals with the grouping of multiple windows, and the tools provided facilitate the specification of screen configurations. Linking tools provide mechanisms to specify and enforce functional dependency between windows, so that when what is in one changes, the other windows change in prespecified ways. GRA

N92-15546# Georgia Inst. of Tech., Atlanta. Center for Human-Machine Systems Research.
INTELLIGENT TUTORING FOR DIAGNOSTIC PROBLEM SOLVING IN COMPLEX DYNAMIC SYSTEMS
Vijay Vasandani Sep. 1991 391 p
(Contract N00014-87-K-0482)
(AD-A242619; CHMSR-91-4) Avail: NTIS HC/MF A17 CSCL 05/9

Maintenance training for diagnostic problem solving in complex dynamic systems is carried out either on the job or on simulators. When simulators are used for training, their effectiveness can be improved by integrating intelligent tutoring systems (ITS) into the training programs. Research results from ITSs developed for simpler task domains are generally not very useful in complex engineered domains due to lack of appropriate knowledge representation techniques. The focus of our research is the development of a methodology for decomposing, organizing, and representing domain knowledge of complex dynamic systems for building functional computer-based intelligent tutors. Using our knowledge representation methodology, we implemented an ITS on an Apple Macintosh II computer for the marine power plant domain. The ITS is comprised of a simulated power plant, the tutor, and mouse-based direct manipulation graphical interfaces.

The ITS was experimentally evaluated using Naval ROTC cadets as subjects. Performance of the subjects was analyzed using measures such as percentage of premature and correct diagnosis and percentage of relevant and irrelevant diagnostic tests. Results show that a simulator alone is inadequate, whereas a simulator in conjunction with an ITS can help develop efficient troubleshooting skills. GRA

N92-15547# Army Natick Research and Development Command, MA.
TECHNICAL OBJECTIVE DOCUMENT FOR COMBAT CLOTHING, UNIFORMS, AND INTEGRATED PROTECTIVE SYSTEMS Final Report, May 1988 - Nov. 1991
D. Anderson and B. Fitzgerald Nov. 1991 37 p
(AD-A242624; NATICK/TR-92/003) Avail: NTIS HC/MF A03 CSCL 15/5

This document provides information on the Army's technical objectives for the Combat Clothing, Uniforms, and Integrated Protective Systems areas to the external community, both government and nongovernment, including academic, scientific, and industrial organizations. Its purpose is to stimulate the participation of such organizations in Army research and development. Areas include: Management Review; Technology Base Investment Strategy; Progress and Accomplishments; Planned Programs; Research, Technology and Development; Major Technical Barriers; and Program Relationships and Interactions. GRA

N92-15548# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
INFLUENCE OF METABOLIC RATE AT 40 C AMBIENT TEMPERATURE ON WORK TOLERANCE TIMES WITH VARYING LEVELS OF CANADIAN FORCES NBC PROTECTIVE CLOTHING
T. M. McLellan Apr. 1991 38 p
(AD-A242773) Avail: NTIS HC/MF A03 CSCL 15/6

The Canadian Forces has a requirement to be prepared to operate in a nuclear, biologically, and/or chemically (NBC) contaminated environment in the event of war. To protect personnel working in this environment from the effects of contaminating agents an individual protective ensemble (IPE) has been developed which consists of a facial mask/respirator, a clothing coverall, overboots and gloves. Depending on the likelihood and severity of the perceived threat, either the coverall alone may be donned or the entire IPE may be donned so that no skin surface and no portion of the usual combat fatigue clothing is exposed to the environment. The components of the IPE are either semi-permeable or impermeable to moisture penetration; thus the ability to evaporate sweat from the skin surface is severely impaired. This study examined the effects of a warm environmental temperature (40 C and 50 pct. relative humidity) and metabolic rate on soldier's work tolerance time (WTT) while wearing various levels of NBC defence protective clothing. Subjects were tested wearing three levels of clothing protection; combat fatigues (Low); fatigues and a semi-permeable NBC overgarment (Med); fatigues and NBC overgarment, gloves, boots and respirator (High). WTT was the time until rectal temperature reached 39.3 C, heart rate reached 95 pct. maximum, dizziness or nausea precluded further exercise, or 5 h had elapsed. GRA

N92-15855*# Alabama Univ., Huntsville. Dept. of Computer Science.
DEVELOPMENT AND APPLICATION OF VIRTUAL REALITY FOR MAN/SYSTEMS INTEGRATION
Marcus Brown *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05H

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N92-15549*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
SEMIANNUAL REPORT, 1 APRIL - 30 SEPTEMBER 1991 Final Report
Nov. 1991 73 p
(Contract NAS1-18605)
(NASA-CR-189567; NAS 1.26:189567) Avail: NTIS HC/MF A04 CSCL 12A

The major categories of the current Institute for Computer Applications in Science and Engineering (ICASE) research program are: (1) numerical methods, with particular emphasis on the development and analysis of basic numerical algorithms; (2) control and parameter identification problems, with emphasis on effective numerical methods; (3) computational problems in engineering and the physical sciences, particularly fluid dynamics, acoustics, and structural analysis; and (4) computer systems and software for parallel computers. Research in these areas is discussed.
Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N92-15550# Naval Postgraduate School, Monterey, CA.
A PERSONAL COMPUTER BASED DSS M.S. Thesis
Donald A. Schmieley Mar. 1991 56 p
(AD-A242625) Avail: NTIS HC/MF A04 CSCL 12/6

A decision support system to select a computer-family using an objective evaluation process is developed. A computer-family is defined as a group of computers from microcomputer to mainframe with compatible operating systems and software. Saaty's analytic hierarchy process is applied to the weighing and scoring stages of the computer-family selection methodology presented by Borovits and Zviran. The result is a decision support system incorporating an objective and comprehensive methodology for computer-family selection. GRA

N92-15551*# Boeing Military Airplane Development, Seattle, WA.
TOWARDS COMPOSITION OF VERIFIED HARDWARE DEVICES
E. Thomas Schubert (California Univ., Davis.), K. Levitt, and G. C. Cohen Nov. 1991 58 p
(Contract NAS1-18586)
(NASA-CR-187504; NAS 1.26:187504) Avail: NTIS HC/MF A04 CSCL 09B

Computers are being used where no affordable level of testing is adequate. Safety and life critical systems must find a replacement for exhaustive testing to guarantee their correctness. Through a mathematical proof, hardware verification research has focused on device verification and has largely ignored system composition

verification. To address these deficiencies, we examine how the current hardware verification methodology can be extended to verify complete systems. Author

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N92-15552*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
NASA-EVOLVING TO Ada: FIVE-YEAR PLAN. A PLAN FOR IMPLEMENTING RECOMMENDATIONS MADE BY THE Ada AND SOFTWARE MANAGEMENT ASSESSMENT WORKING GROUP
Apr. 1989 36 p
(NASA-TM-105444; NAS 1.15:105444) Avail: NTIS HC/MF A03 CSCL 09B

At their March 1988 meeting, members of the National Aeronautics and Space Administration (NASA) Information Resources Management (IRM) Council expressed concern that NASA may not have the infrastructure necessary to support the use of Ada for major NASA software projects. Members also observed that the agency has no coordinated strategy for applying its experiences with Ada to subsequent projects (Hinners, 27 June 1988). To deal with these problems, the IRM Council chair appointed an intercenter Ada and Software Management Assessment Working Group (ASMAWG). They prepared a report (McGarry et al., March 1989) entitled, 'Ada and Software Management in NASA: Findings and Recommendations'. That report presented a series of recommendations intended to enable NASA to develop better software at lower cost through the use of Ada and other state-of-the-art software engineering technologies. The purpose here is to describe the steps (called objectives) by which this goal may be achieved, to identify the NASA officials or organizations responsible for carrying out the steps, and to define a schedule for doing so. This document sets forth four goals: adopt agency-wide software standards and policies; use Ada as the programming language for all mission software; establish an infrastructure to support software engineering, including the use of Ada, and to leverage the agency's software experience; and build the agency's knowledge base in Ada and software engineering. A schedule for achieving the objectives and goals is given. Author

N92-15553# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
THE ALGEBRAIC MANIPULATION PROGRAM DIRAC ON IBM PERSONAL COMPUTERS
A. G. Grozin and H. Perlt 1989 24 p
(DE91-630955; JINR-E-11-89-537) Avail: NTIS HC/MF A03

The version DIRAC (2.2) for IBM compatible personal computers is described. It is designed to manipulate algebraically with polynomials and tensors. After a short introduction concerning implementation and usage on personal computers an example program is given. It contains a detailed user's guide to DIRAC (2.2) and, additionally some useful applications. DOE

N92-15554# Sandia National Labs., Albuquerque, NM.
SRIM CODE MANAGEMENT AT SANDIA NATIONAL LABORATORIES
T. D. Sullivan 1991 20 p Presented at the Intelligence Community Modeling Group, Ann Arbor, MI, 15-19 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-000952; SAND-91-2257C; CONF-9110235-1) Avail: NTIS HC/MF A03

The report discusses the conversion of SRIM code to run on a Cray XMP-4/16 under the Cray Time Sharing System (CTSS). Also discussed is the CONTED code. The Context Editor (CONTED)is a batch editor that makes changes to test files based on context rather than position. The editor applies a modification using, as a point of reference, a specified static group of text called a 'tag,' that appears in the base text file. It is designed to operate as a standard UNIX filter program, similar to SED. The tag concept provides for the specification of a more rigorous point of reference for modifications than a line number or pattern of text within a line. CONTED operates on sets of contiguous lines or 'groups,' rather than on lines or patterns within a line. Since a group can be composed of a single line, CONTED can be made to operate on a line basis. DOE

N92-15555# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
THE TOOLS PACKAGE FOR REDUCE, VERSION 1.1
Marcel Roelofs Mar. 1991 24 p
(MEMO-942; ISSN-0169-2690; ETN-92-90335) Avail: NTIS HC/MF A03

The WEB source of the TOOLS package for REDUCE is given. This package contains procedures facilitating the use of algebraic operators in automatic computations, including implementation of multilinear operators, solving linear expressions and finding coefficients of operator elements in algebraic expressions and basis elements of polynomial rings in an arbitrary number of variables. ESA

N92-15556# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
THE LIESUPER PACKAGE FOR REDUCE, VERSION 1.1
Marcel Roelofs Mar. 1991 86 p
(MEMO-943; ISSN-0169-2690; ETN-92-90336) Avail: NTIS HC/MF A05

The WEB source of the LIESUPER package for REDUCE is given. The package defines the Lie bracket as a new data type in REDUCE, and thus enables symbolic computations in (free) Lie (super) algebras. Further features include automatic checking of Jacobi identities, use of integer valued multigradings and basis transformations of Lie (super) algebras. ESA

N92-15557# Universiteit Twente, Enschede (Netherlands). Dept. of Computer Science.
SPECIFICATION AND PROTOTYPE OF A SCANNER GENERATOR
M. T. P. C. vanHintum 8 May 1991 54 p
(Memo-INF-91-36; ISSN-0923-1714; ETN-92-90353) Avail: NTIS HC/MF A04

The specification of a scanner generator and a prototype implementation in a functional programming language are discussed. A functional language is used because it allows algorithms to be expressed in a concise way. However, programs written in functional languages do not run very efficiently. Therefore improvement of efficiency without affecting the structure of the original scanner generator algorithm is discussed. ESA

N92-15558# Universiteit Twente, Enschede (Netherlands). Dept. of Computer Science.
AN EFFICIENT ATTRIBUTE EVALUATION METHOD FOR ALL L-ATTRIBUTED LR GRAMMARS
Petr Pavlu (Czech Technical Univ., Prague.) May 1991 40 p
Sponsored by Commission of the European Communities
(Memo-INF-91-37; ISSN-0923-1714; ETN-92-90354) Avail: NTIS HC/MF A03

A method which allows an efficient combination of LR parsing and attribute evaluation for an arbitrary L attributed LR grammar is presented. Each attribute is evaluated during parsing as soon as possible, and the evaluation is completed before parsing of the input string is finished. Without imposing any restrictions on the attribute dependencies in a given L attributed grammar, this strategy results in an optimal compromise between the usual one pass and two pass attribute evaluation schemes for L attributed grammars. ESA

N92-15559# Universiteit Twente, Enschede (Netherlands). Tele-Informatics and Open Systems Group.
A DISTRIBUTED BANDWIDTH ALLOCATION ALGORITHM
F. V. Baumann and A. Pras May 1991 10 p Presented at the 9th Annual European Fiber Optic Communications and Local Area Network Conference, 19-21 Jun. 1991 Sponsored by Netherlands PTT
(Memo-INF-91-39; TIOS-91/012; ISSN-0923-1714; ETN-92-90355)
Avail: NTIS HC/MF A02

A new bandwidth allocation algorithm is presented. This algorithm can be used in communication systems with a limited capacity, such as LANs (Local Area Networks). A common approach for bandwidth allocation algorithms is to take a central master to perform this function. A distributed and fault tolerant approach is described. The algorithm is fault tolerant with respect to the failure of one or more stations, and to the loss of messages. Possible applications can be found in integrated voice/data networks and industrial LANs. ESA

N92-15560# Universiteit Twente, Enschede (Netherlands). Tele-Informatics and Open Systems Group.
TEST DERIVATION FOR FULL LOTOS M.S. Thesis
Peter Doornbosch Apr. 1991 82 p
(Memo-INF-91-51; TIOS-91/020; ISSN-0923-1714; ETN-92-90366)
Avail: NTIS HC/MF A05

The derivation of testers for conformance testing from full Language Of Temporal Ordering Specification (LOTOS) specifications is discussed. The existing theory on test derivation only covers basic LOTOS, or (more generally) labeled transition systems. As full LOTOS is also defined in terms of labeled transition systems, it is possible to apply this theory to full LOTOS as well. However, this approach seems to be needlessly complicated and results in unmanageably large testers. The solution of this problem is based on the resemblance between basic and full LOTOS. Full LOTOS is basic LOTOS extended with the possibility of value passing. By representing full LOTOS alternatively, in so called parameterized labeled transition systems, it is possible to apply the existing algorithm for test derivation with a few extensions to simple full LOTOS behavior expressions. In a few steps, a method is constructed that derives testers for a subset of full LOTOS, only excluding internally chosen variables and conditional internal events (i.e., with predicates associated). In terms of language elements, this means that the hide operator, the exit (any) construct, guarded internal events, and the generalized choice operator cannot be handled. A proof is given that this method indeed produces correct testers. Some problems that arise when tests have to be derived from specifications containing elements of full LOTOS that are not incorporated in the method, are identified. ESA

N92-15561# Universiteit Twente, Enschede (Netherlands). Tele-Informatics and Open Systems Group.
TEST SELECTION IN CONFORMANCE TESTING M.S. Thesis
Louis Verhaard Mar. 1991 74 p
(Memo-INF-91-52; TIOS-91/021; ISSN-0923-1714; ETN-92-90367)
Avail: NTIS HC/MF A04

Algorithms exist for the derivation of complete testers for protocols, specified in the formal description language basic Language Of Temporal Ordering Specification (LOTOS). In practice, it is not possible to execute all test cases of this tester. This is because, at most times, the number of cases is infinite or so large that exhaustive testing would be too expensive. For this reason, it is necessary to select a finite subset from all cases. This should be done in a such way that the costs of the resulting tester are as low as possible while the testing power remains as high as possible. Testing power could be defined as the probability that a tester reveals certain errors, or the extent to which certain critical parts of the protocol are tested. First ideas for the design of measures for the costs and testing power of a tester are presented with much attention given to the testing power because this is (theoretically) the most interesting. The basic idea for determining the testing power is that it should be based on the implementations that are recognized by the tester as being incorrect. Several ways are presented to classify implementations into error classes, and to assign values to these errors classes. Attention is given to test selection for specification in full LOTOS. ESA

N92-15562# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
A PROJECTIVE VARIANT OF THE APPROXIMATE CENTER METHOD FOR LINEAR PROGRAMMING
C. Roos 1990 30 p Revised
(Rept-90-83; Rept-88-44; ISSN-0922-5641; ETN-92-90371)
Copyright Avail: NTIS HC/MF A03

A projective method for linear programming based on the use of a multiapplicative barrier function is addressed. As a consequence of the method being path following, the initial iterate must be close to the central path. The performance depends on the choice of the exponent mu in the numerator of the barrier function. If mu = n + 1, then the barrier function is the same as earlier considered by Yamashita, and also by Iri and Imai. These authors considered a potential reduction method, and Yamashita derived an O(square root of nL) iteration bound. The same iteration bound, i.e. O((square root of n)L), occurs for larger values of mu, e.g., mu = 2n. This value of mu was used in an earlier paper of the author, and yielded the same complexity bound in a different way. The analysis in this paper is relatively simple, and resembles the analysis of the approximate center method for linear programming, as proposed by Roos and Vial. ESA

N92-15563# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
PARALLEL NEWTON-RAPHSON METHODS FOR UNCONSTRAINED MINIMIZATION WITH ASYNCHRONOUS UPDATES OF THE HESSIAN MATRIX OR ITS INVERSE
F. A. Lootsma 1991 21 p
(Rept-91-02; ISSN-0922-5641; ETN-92-90382) Copyright Avail: NTIS HC/MF A03

A parallel variant of the Newton-Raphson method for unconstrained optimization, which uses as many finite differences of gradients as possible to update the inverse Hessian matrix, is considered. The method is based on the Gauss-Seidel type of updating for quasi Newton methods originally proposed by Straeter (1973). It incorporates the finite difference approximations via the symmetric rank one updates analyzed by Van Laarhoven (1985). The potential of the method for on line, real time optimization is discussed. The development of hardware for parallel computing has been so turbulent, and the development of programming languages for parallel processing has been so slow, that it is still unreasonable to expect a large market for standard optimization software. Hence, the study is restricted to the testing of algorithmic ideas on sequential computers. Moreover, the asynchronous method of Fischer and Ritter (1988) which uses finite differences of gradients to update as many rows and columns as possible of the Hessian matrix itself is considered. The test results reveal both promising research directions as well as possible pitfalls for parallel unconstrained optimization. ESA

N92-15564# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
CUT IMPLEMENTATION IN PROLOG
Pawel Kruszynski 1991 28 p
(Rept-91-04; ISSN-0922-5641; ETN-92-90384) Copyright Avail: NTIS HC/MF A03

The existing semantics of CUT in PROLOG are reviewed, and problems arising in connection with CUT in the implementation of the Warren Abstract Machine are addressed. CUT in PROLOG is a simple nonlogical built in predicate controlling backtracking. ESA

N92-15565# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
A PROLOG IMPLEMENTATION OF A TABULAR BOTTOM-UP RECOGNIZER

Pawel Kruszynski and J. P. M. deVreught 1991 19 p
(Rept-91-05; ISSN-0922-5641; ETN-92-90385) Copyright Avail: NTIS HC/MF A03

An algorithm, essentially parallel to a recently developed double dotted algorithm of parsing and recognizing for context free grammars not necessarily in Chomsky normal form is addressed. Its preliminary implementation in sequential PROLOG is outlined. The aim is the development of the general structure of an implementation, refinement of the algorithm, determination of data structures, etc. It will serve as some kind of specification for an intended parallel implementation of the algorithm in a parallel dialect of PROLOG. ESA

N92-15566# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
PROMISE: A PROLOG MACHINE
Pawel Kruszynski, Ruud Sommerhalder, Alwin Bliek, Arjen Duursma, Arnoud Ekker, and Alexander Vonk 1991 70 p
(Contract JSA-87-2009)
(Rept-91-06; ISSN-0922-5641; ETN-92-90386) Copyright Avail: NTIS HC/MF A04

A project document for PROLOG Machine Interpreting System and Environment (PROMISE) is presented. Goals to be achieved are formulated and design decisions with respect to PROMISE, together with supporting arguments, are given. The architecture of the PROMISE software, covering the partition of the software in modules, the interface between the modules, and the functional specification of the modules is outlined. The actual state of the project is characterized. ESA

N92-15567# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
THE CERTAINTY FACTOR MODEL IN LORE: NOTES ON THE IMPLEMENTATION
Bob Goedhart and Gerry Noij 1991 30 p
(Rept-91-18; ISSN-0922-5641; ETN-92-90398) Copyright Avail: NTIS HC/MF A03

The knowledge representation language LORE combines the representation formalisms of frames, production rules and logic programming. In addition, advanced techniques such as strong typing, multiple inheritance and modularization are supported. Thus far, LORE lacked a built in model for inexact reasoning, which made it less suited to applications in which uncertainty plays a major role. For this reason, an existing model for the representation and propagation of uncertainty (Buchanan and Shortliffe's certainty factor model) was modified to make it applicable in a more general environment. ESA

N92-15568# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
SKEPTICAL REASON MAINTENANCE AND BELIEF REVISION
Cees Witteveen and Gerhard Brewka (Gesellschaft fuer Mathematik und Datenverarbeitung, Saint Augustin, Germany, F.R.) 1991 33 p
(Rept-91-25; ISSN-0922-5641; ETN-92-90404) Copyright Avail: NTIS HC/MF A03

The skeptical semantics is a three valued semantics for reason maintenance based on an extension of the well known two valued stable model semantics. Unlike the latter, however, the skeptical semantics is tractable: using a reduction to negation free reason maintenance, the skeptical model can be computed in O(n squared) time. The skeptical semantics can also be used to give a better account of the belief revision problem in reason maintenance. A recent logical reconstruction of dependency directed backtracking (DDB) offers the possibility to represent different DDB strategies by different extensions of a reason maintenance system. Given a reason maintenance system D, a class of extensions representing all possible DDB strategies for D is distinguished. It is proven that within this class there exists a unique extension whose skeptical model can be used as a canonical, information minimal belief revision model. This skeptical belief revision model has some important advantages: the arbitrariness of solutions found by classical dependency directed backtracking methods can be avoided; the semantics guarantees (tractable) incremental updating method, and this method satisfies a weak rationality postulate ensuring the minimality of performed changes; and the skeptical belief revision is a complete belief revision strategy and is easy to compute, having a worst case complexity O(n cubed). ESA

N92-15569# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
INVERSE BARRIER METHODS FOR LINEAR PROGRAMMING
D. denHertog, C. Roos, and T. Terlaky 1991 29 p Sponsored in part by Shell, Netherlands
(Contract OTKA-2116)
(Rept-91-27; ISSN-0922-5641; ETN-92-90406) Copyright Avail: NTIS HC/MF A03

In the recent interior point methods for linear programming, much attention has been given to the logarithmic barrier method. A class of inverse barrier methods for linear programming is analyzed. Upper bounds for the total number of iterations needed to obtain an epsilon optimal solution are derived. Unfortunately, these bounds are not polynomial in the input length. Only if the remark goes to zero is a polynomiality result achieved, but then we are actually working with the logarithmic barrier method. ESA

N92-15570# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
A SEMI-AUTOMATIC ASSEMBLY SEQUENCE PLANNER
Jacob J. Waarts, Nico Boneschanscher, and Willem F. Bronsvoort 1991 29 p Sponsored by Netherlands SPIN/FLAIR
(Rept-91-29; ISSN-0922-5641; ETN-92-90408) Copyright Avail: NTIS HC/MF A03

In process planning for flexible assembly, it is necessary to determine several feasible assembly sequences. Each such sequence lists an order in which the parts of a product can be assembled. To assist the user in determining feasible assembly sequences, an Assembly Sequence Planner (ASP) was developed and implemented. With the aid of this planner, the user first groups the parts of the product into subassemblies and clusters. Next, the feasible sequences for each group are determined. A feasible sequence consists of valid assemblies and valid assembly actions only. An assembly is valid if it is stable. An assembly action is valid if the assembly is accessible to the part to be assembled. These criteria, stability and accessability, are used by the sequence planner to check whether an assembly sequence is feasible. The user may always overrule the result of these checks, and can thus direct planning process. ESA

N92-15571# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
LINEAR INTERVAL ROUTING SCHEMES
Arwin M. Bakker, Jan vanLeeuwen, and Richard B. Tan (Utrecht State Univ., Netherlands) Feb. 1991 20 p Sponsored in part by EEC
(RUU-CS-91-7; ISSN-0924-3275; ETN-92-90471) Avail: NTIS HC/MF A03

A variant of 'internal routing', when the routing range associated with every link is represented by a linear (i.e., contiguous) interval with no wrap around, is studied. This kind of routing scheme arises naturally in the study of dynamic 'prefix routing'. Linear interval routing schemes are precisely the prefix routing schemes that use an alphabet of one symbol. The type of networks that admit optimum linear interval routing schemes are characterized. It is shown that several well known interconnection networks such as hypercubes, certain n-tori, and n-dimensional grids, all with unit-cost links, have optimum linear interval routing schemes. The multi label interval routing schemes where each link may contain more than one label are also introduced, and several characterization results for these schemes are proved. ESA

N92-15572# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
A SIMPLE LINEAR TIME ALGORITHM FOR TRIANGULATING THREE-COLORED GRAPHS
Hans Bodlaender and Ton Kloks May 1991 14 p Sponsored

in part by Netherlands Foundation for Computer Science (Contract EEC-3075)
(RUU-CS-91-13; ISSN-0924-3275; ETN-92-90477) Avail: NTIS HC/MF A03

The problem of determining whether a given colored graph can be triangulated, such that no edges between vertices of the same color are added, is considered. This problem originated from the perfect phylogeny problem from molecular biology, and is strongly related with the problem of recognizing partial k trees. A simple linear time algorithm that solves the problem when there are three colors is presented by first giving a complete structural characterization of the class of partial 2 trees. An algorithm that solves the problem for partial 2 trees is also given. ESA

N92-15573# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
HIGHER ORDER ATTRIBUTE GRAMMARS, LECTURE NOTES OF THE INTERNATIONAL SUMMER SCHOOL ON ATTRIBUTE GRAMMARS, APPLICATIONS AND SYSTEMS
S. D. Swierstra and H. H. Vogt Jun. 1991 52 p
(RUU-CS-91-14; ISSN-0924-3275; ETN-92-90478) Avail: NTIS HC/MF A04

The basic definitions for higher order attribute grammars are presented and compared with attribute coupled grammars, extended affix grammars and functional programming languages. The description of multipass compilers and user interface management systems in this way is indicated. It is shown that, especially in the case of incremental evaluation, the conventional execution model has to be generalized. Such a model, based on function caching, hash consing and combinator construction is discussed. This model encompasses many of the more ad hoc optimizations found in standard implementations of normal attribute grammars. ESA

N92-15574# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
EXTENDED TERM REWRITING SYSTEMS
Jan Willem Klop and Roel C. deVrijer (Amsterdam Univ., Netherlands) Jan. 1991 28 p Presented at the Workshop on Conditional and Typed Rewriting Systems, Montreal, Quebec, Jun. 1990 Submitted for publication Sponsored in part by EEC
(CWI-CS-R9107; ETN-92-90547) Copyright Avail: NTIS HC/MF A03

Some extensions of the usual term rewrite format, namely term rewriting with conditions, infinitary term rewriting and term rewriting with bound variables are considered. Rather than aiming at a complete survey, some aspects of these three extensions are discussed: infinite term rewriting; conditional term rewriting systems; combinatory reduction systems. ESA

N92-15575# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
THE CURRENT STATE OF BISIMULATION TOOLS
Henri P. Korver Feb. 1991 31 p
(CWI-CS-R9108; ETN-92-90548) Copyright Avail: NTIS HC/MF A03

It is a well known fact that descriptions of concurrent systems often appear to be incorrect, in the sense that the behavior of the system does not correspond to the behavior the specifier had in mind. To overcome this problem, a lot of research has been going on in the field of formal verification methods of software descriptions. At the moment, bisimulation is one of the most popular criteria for guaranteeing correctness of concurrent system descriptions. In this approach, concurrent systems are modeled as transition graphs, and verification amounts to establishing that the graph representing the implementation of the system is bisimilar to the graph representing the specification of the system. The main advantage of this approach is that bisimulation can be decided efficiently and fully automatically on finite transition graphs. A comparative evaluation of bisimulation techniques, as found in the following tools, is presented: ACP bisimulation tool; branching bisimulation tool; Aldebaran; the Concurrency Workbench (CWB); Tool for Automatic Verification (TAV); Winston; Auto, Autograph and Ecrins. The usability of these tools for PSF (Process Specification Formalism) is investigated. PSF is proposed as a suitable representative of a wide range of formalism that have come up for specify concurrent systems. ESA

N92-15576# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
PARAMETRIC SURFACES IN PHIGS PLUS: A NEW CHANGE FOR PATTERNING AND HATCHING
Miente Bakker Feb. 1991 11 p Revised
(CWI-CS-R9109; ETN-92-90549) Copyright Avail: NTIS HC/MF A03

The Polygon Fill styles PATTERN and HATCH, which are quite successful in two dimensional graphics standards such as GKS (Graphical Kernel System) and CGI (Computer Graphical Interface) have proved to be less suitable for three dimensional graphics standards as GKS-3D and PHIGS (Programmer's Hierarchical Interacticve Graphics System). However, the emerging standard PHIGS PLUS offers a unique chance to successfully employ these Interior Styles (under another name and in a slightly different from), because PHIGS PLUS supports inter alia topologically rectangular parametric surfaces. The efficient application of these Interior Styles to curved surfaces in PHIGS PLUS is shown. The possible interaction between the tessellation method and the patterning is shown. ESA

N92-15577# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
PROVING TERMINATION OF GENERAL PROLOG PROGRAMS
Krzysztof R. Apt and Dino Pedreschi (Pisa Univ., Italy) Feb. 1991 26 p Presented at the International Conference on Theoretical Aspects of Computer Software, Sendai, Japan, 1991 Submitted for publication Sponsored in part by EEC
(CWI-CS-R9111; ETN-92-90551) Copyright Avail: NTIS HC/MF A03

Termination of general logic programs with the PROLOG selection rule is studied. To this end, the approach of Apt and Pedreschi is extended and the class of left terminating general programs are considered. These are general logic programs that terminate with the PROLOG selection rule for all ground goals. The notion of an acceptable program is introduced and acceptable programs are proved to be left terminating. This provides a practical method of proving termination. The converse implication does not hold but it is shown that under the assumption of non floundering from ground goals every lift terminating program is acceptable. Various ways of defining semantics are proved to coincide for acceptable programs. The method is illustrated by giving simple proofs of termination of a 'game' program and the transitive closure program for the desired class of goals. ESA

N92-15578# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
RANDOMIZED WAIT-FREE TEST-AND-SET
John T. Tromp and Paul M. B. Vitanyi (Amsterdam Univ., Netherlands) Mar. 1991 16 p Submitted for publication
(CWI-CS-R9113; ETN-92-90553) Copyright Avail: NTIS HC/MF A03

It is known to be impossible to implement wait free test and set deterministically in a concurrent setting using only atomic shared variables. The first explicit randomized algorithm for any wait concurrent object is presented: a test and set bit shared between 52 processes, implemented with two 4 valued Single writer single reader atomic variables. The worst case (over all adversary schedulers) expected number of steps to execute a test and set between two processes is at most 11, while the reset takes exactly 1 step. Based on a finite state analysis, the proofs of correctness and expected length are compressed into one table. ESA

N92-15579# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
DYNAMIC INTERPRETATION AND HOARE DETECTION

D. Jan N. vanEijck and Fer-Jan deVries Mar. 1991 30 p
(CWI-CS-R9115; ETN-92-90554) Copyright Avail: NTIS HC/MF A03

A dynamic assignment language with eta and iota assignment in the style of the dynamic predicate logic extended with generalized quantifiers is presented. The constructors eta and iota assignment allow a very straightforward analysis of indefinite and definite descriptions in natural language, while the dynamic treatment of generalized quantifiers is intended to cover the dynamic interaction of quantification and description in natural language. The use of this Dynamic Assignment Language (DAL) for natural language analysis is demonstrated by examples. The medium can treat a wide variety of 'donkey sentences': conditionals with a donkey pronoun in their consequent and quantified sentences with donkey pronouns anywhere in the scope of the quantifier. The account does not suffer from the 'proportion' problem. Discussions about the correctness or incorrectness of proposals for dynamic interpretation of language were hampered in the past by the difficulty of seeing through the ramifications of the dynamic semantic clauses (phrased in terms of input-output behavior) in nontrivial cases. To remedy this, the dynamic semantics of the representation language is supplemented with an axiom system in the style of Hoare. The rules proposed from a deduction system for DAL which is proven correct and complete with respect to the semantics. The static meaning of a DAL program pi is defined as the weakest condition psi such that pi terminates successfully on all states satisfing psi, and the calculus is shown to give a straightforward method for finding static meanings of DAL programs. ESA

N92-15580# Nijmegen Univ. (Netherlands). Dept. of Informatics.
AFFIX GRAMMARS FOR PROGRAMMING LANGUAGES
C. H. A. Koster Apr. 1991 18 p
(TR-91-16; ETN-92-90686) Avail: NTIS HC/MF A03

Affix Grammars over a Finite Lattice (AGFL's), a simple form of two level grammars admitting quite efficient implementations, are proposed as a formalism to express the syntax of natural languages. AGFL's are a formalization of the following notion: context free grammars are augmented with features for expressing agreement between parts of speech where the features form a finite categorization. Conjugation and declination rules based on feature distinctions can be modeled in AGFL's. The concepts and notation of AGFLs are described. A brief example is given of their use in describing a fragment of the English language, followed by a discussion of issues like parsing and ambiguity. ESA

N92-15581 Politecnico di Milano (Italy). Dipartimento di Elettronica.
INTEGRATING QUALITATIVE AND QUANTITATIVE MODELING
Andrea Bonarini and Vittorio Maniezzo Jun. 1990 21 p Sponsored in part by CNR and Commission of the European Communities
(Rept-90-026; ETN-92-90718) Avail: Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

A method for integrating constrained base qualitative simulation with standard numerical simulation is presented. Second generation expert systems are characterized by the use of models of the application domain at different levels of detail and focused on different aspects of the same process. Numerical models are available, but they are inadequate as a basis for reasoning. Qualitative models are effective as deep representations for knowledge based systems, but too underdefined in their behavioral prescriptions. For both the qualitative and the quantitative approaches, problems grow with the dimension of the simulated system. A method to integrate these two modeling paradigms is presented. It is assumed that the system to be modeled can be partitioned in two parts interacting through shared variables. One part is described qualitatively and the other one quantitatively. The parallel evolutions of the two simulation/monitoring processes are based on a qualitative interpretation of the numerical course of the shared variables. ESA

N92-15582 Politecnico di Milano (Italy). Dipartimento di Elettronica.
THE USE OF ASTRAL, AN ASSERTION LANGUAGE FOR SPECIFICATION OF REAL-TIME SYSTEM, AS A HARDWARE DESCRIPTION LANGUAGE
William Fornaciari 1991 26 p Sponsored by SGS-Thomson
(Rept-91-029; ETN-92-90720) Avail: Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

The use of ASTRAL, an assertion language for specification and design of real time systems, as a hardware description language, is presented. ASTRAL is based on ASLAN and RT-ASLAN. The specification of two hardware systems is provided. The examples showed that ASTRAL could be viewed as an effective hardware description language. The main advantages of using ASTRAL rather than other approaches come from its modularity and its abstractness. The process of designing a system leads to a sequence of specification, each one containing more details than the previous ones. The last specification might be used as input to a tool performing high level synthesis. ASTRAL is based on predicate calculus, so that formal verification activities can be performed. ASTRAL semantics are defined by use of TRIO. As a consequence, bit functional and timing requirements can be verified. ASTRAL specifications are composed of modules and modularization of specifications is an advantage since they are more manageable and readable with respect to a TRIO specification without losing expressiveness. ESA

N92-15583# Argonne National Lab., IL.
A TAXONOMY OF AUTOMATIC DIFFERENTIATION TOOLS
D. W. Juedes (Iowa State Univ. of Science and Technology, Ames.) 1991 19 p Presented at the Society for Industrial and Applied Mathematics (SIAM) Workshop on Automatic Differentiation of Algorithms: Theory, Implementation, and Application, Breckenridge, CO, 6-8 Jan. 1991
(Contract W-31-109-eng-38)
(DE92-001881; ANL/CP-74447; CONF-910189-3) Avail: NTIS HC/MF A03

Many of the current automatic differentiation (AD) tools have similar characteristics. Unfortunately, the similarities between these various AD tools often cannot be easily ascertained by reading the corresponding documentation. To clarify this situation, a taxonomy of AD tools is presented. The taxonomy places AD tools into the Elemental, Extensional, Integral, Operational, and Symbolic classes. This taxonomy is used to classify twenty-nine AD tools. Each tool is examined individually with respect to the mode of differentiation used and the degree of derivatives computed. A list detailing the availability of the surveyed AD tools is provided in the Appendix. DOE

N92-15584# Pacific Northwest Lab., Richland, WA.
R/D SOFTWARE QUALITY ASSURANCE
F. C. Hood Oct. 1991 8 p Presented at the 18th Annual American Society of Quality Control (ASQC) National Energy Division Conference, Danvers, MA, 6-9 Oct. 1991
(Contract DE-AC06-76RL-01830)
(DE92-002137; PNL-SA-19670; CONF-9110102-5) Avail: NTIS HC/MF A02

Research software quality assurance (QA) requirements must be adequate to strengthen development or modification objectives, but flexible enough not to restrict creativity. Application guidelines are needed for the different kinds of research and development (R&D) software activities to assure project objectives are achieved. DOE

N92-15585# Information Systems and Technology Center, Wright-Patterson AFB, OH. Validat Ion Facility.
Ada COMPILER VALIDATION SUMMARY REPORT. CERTIFICATION NUMBER: 910130W1.11114, ENCORE COMPUTER CORPORATION PARALLEL Ada DEVELOPMENT SYSTEM, REVISION 1.0, ENCORE 91 SERIES (MODEL NO. 91-0340) UNDER UMAX 3.0 (HOST) ENCORE 91 SERIES (MODEL NO. 91-0340) (TARGET) UNDER UMAX 3.0 Final

Report
5 Sep. 1991 56 p Sponsored by DOD
(AD-A242474) Avail: NTIS HC/MF A04 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N92-15586# Virginia Polytechnic Inst. and State Univ., Blacksburg. Management Systems Lab.
AUTOMATING A DETAILED COGNITIVE TASK ANALYSIS FOR STRUCTURING CURRICULUM Quarterly Progress Report No. 2, Jun. - Aug. 1991
Kent E. Williams Aug. 1991 9 p
(Contract N00014-91-J-1500)
(AD-A242506) Avail: NTIS HC/MF A02 CSCL 05/8

An area of interest which you may wish to consider for psychological research is the determination of the strategy/strategies which experts employ in retrieval and recall of their expert knowledge bases when interacting with a knowledge acquisition system. We have some indirect guidance from the literature on programming and the design of software systems by experts relative to how knowledge for episodes is stored in memory and how experts search for information to solve problems. We are, however, at a loss for anything that directly addresses the issue of how entire knowledge bases of expertise are unpacked from memory (i.e., top-down best first, top-down breadth first or depth first, bottom-up, etc.). We have assumed a top-down breadth first strategy primarily as a result of intuition and from the research in expert design of software programs. GRA

N92-15587# Software Productivity Consortium, Herndon, VA.
Ada QUALITY AND STYLE: GUIDELINES FOR PROFESSIONAL PROGRAMMERS Final Report
1991 194 p
(AD-A242525; SPC-91061-N) Avail: NTIS HC/MF A09 CSCL 12/5

This book is intended to help the computer professional produce better Ada programs. It presents a set of specific guidelines for using the powerful features of Ada in a disciplined manner. Each guideline consists of a concise statement of the principles that should be followed and a rationale explaining why following the guideline is important. In most cases, an example of the use of the guideline is provided, and in some cases a further example is included showing the consequences of violating the guideline. Possible exceptions to the application of the guideline are explicitly noted, and further explanatory notes, including notes on how the guideline could be automated by a tool, are provided where appropriate. Many of the guidelines are specific enough to be adopted as corporate or project programming standards. Others require a managerial decision on a particular instantiation before they can be used as standards. In such cases, a sample instantiation is presented and used throughout the examples. Such instantiations should be recognized as weaker recommendations than the guidelines themselves. These issues are discussed in Section 1.4 of this introduction. Other sections of the introduction discuss how this book should be used by various categories of software development personnel. GRA

N92-15588# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
MATERIALS TO SUPPORT TEACHING A PROJECT-INTENSIVE INTRODUCTION TO SOFTWARE ENGINEERING Final Report
James E. Tomayko Jul. 1991 10 p
(Contract F19628-90-C-0003)
(AD-A242547; CMU/SEI-91-EM-6) Avail: NTIS HC/MF A02 CSCL 12/5

In a project-intensive introduction to software engineering at Carnegie Mellon University (CMU), students developed an interactive exhibit for the Kansas Cosmosphere and Space Center. In a similar course at The Wichita State University, students modified the original CMU project to fit new customer requirements. This package of educational materials provides the software products and documents developed by the students in these courses, along with lesson plans, exams, and other materials used by the instructors. GRA

N92-15589# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
A SOFTWARE ENGINEERING PROJECT COURSE WITH A REAL CLIENT Final Report
Bernd Bruegge, John Cheng, and Mary Shaw Jul. 1991 50 p
(Contract F19628-90-C-0003)
(AD-A242548; CMU/SEI-91-EM-4) Avail: NTIS HC/MF A03 CSCL 12/5

At Carnegie Mellon University, we taught an introductory software engineering course that was organized around a project with a real deliverable for a real client. This case study describes the background and organization of the course and presents the lecture and project materials produced by the faculty and students of the course. Carnegie Mellon University has offered a course in software engineering since the early 1970s. Although its organization and position in the curriculum have changed over the years, the course has always had the primary objective of teaching undergraduate students something about the practical problems of building real-world software--groups of people must cooperate to understand just what problem is being solved and then create and integrate a collection of software modules that solve the problem. This traditionally has been a group-project course with a lecture component. In recent years it has been a senior-level elective; its prerequisites are intended to ensure that students have already studied medium-sized systems such as compilers and operating systems. Often students who select this course are considering entering the job market as software developers. GRA

N92-15590# National Inst. of Standards and Technology, Gaithersburg, MD.
Ada COMPILER VALIDATION SUMMARY REPORT: CERTIFICATION NUMBER 910918S1.11216, NEC CORPORATION, NEC Ada COMPILER SYSTEM FOR EWS-UX/V (REL 4.0), VERSION RELEASE 2.1(4.6) EWS4800/220 (HOST) EWS4800/220 (TARGET) Final Report
18 Sep. 1991 77 p Sponsored by DOD
(AD-A242609) Avail: NTIS HC/MF A05 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the

maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N92-15591# Air Force Avionics Lab., Wright-Patterson AFB, OH.
THE DESIGN AND IMPLEMENTATION OF THE ARIEL ACTIVE DATABASE RULE SYSTEM Final Report, Sep. 1988 - Sep. 1991
Eric N. Hanson and William R. Baker Oct. 1991 47 p
(AF Proj. 2003)
(AD-A242682; WL-TR-91-1122) Avail: NTIS HC/MF A03
CSCL 12/7

This paper describes the design and implementation of the Ariel DBMS and it's tightly-coupled forward-chaining rule system. The query language of Ariel is a subset of POSTQUEL, extended with a new production-rule sublanguage. Ariel supports traditional relational database query and updates operations efficiently, using a System R-like query processing strategy. In addition, the Ariel rule system is tightly coupled with query and update processing. Ariel rules can have conditions based on a mix of patterns, events, and transitions. For testing rule conditions, Ariel makes use of a discrimination network composed of a special data structure for testing single-relation selection conditions efficiently, and a modified version of the TREAT algorithm, called A-TREAT, for testing join conditions. The key modification to TREAT (which could also be used in the Rete algorithm) is the use of virtual a-memory nodes which save storage since they contain only the predicate associated with the memory node instead of copies of data matching the predicate. The rule-action executor in Ariel binds the data matching a rule's condition to the action of the rule at rule fire time, and executes the rule action using the query processor. GRA

N92-15592# Army Materials Technology Lab., Watertown, MA.
A PASCAL PROGRAM FOR MASS SPECTRAL ISOTOPE CLUSTER IDENTIFICATION Final Report
I-Jong Lin and David A. Bulpett Sep. 1991 32 p
(AD-A242685; MTL-TR-91-36) Avail: NTIS HC/MF A03 CSCL 14/2

A new isotope cluster identification program, named Reverse Cluster Search (RCS) is presented in full to assist the mass spectrometrist in the identification of unknowns. Given a clean, complete isotope cluster from a mass spectrum, its empirical formula can be found through the calculations of RCS. RCS was tested on known spectra which fit certain parameters of composition and spectral quality. Correlation between the matches given by RCS and the actual formula was excellent. RCS was written to run on both a DEC VAXStation 3500 and IBM PC compatibles. A companion program is also included which is called Forward Cluster Search (FCS). FCS will calculate theoretical mass spectral isotope clusters from empirical formula data. The purpose of this report is to provide the complete code for a Pascal program which is called Reverse Cluster Search (RCS). Our goal was to develop a computer program to rapidly identify chemical formulas from mass spectral isotope cluster data requiring minimal disk storage and memory. Relying entirely upon low resolution mass spectral cluster data to predict or confirm empirical formulas is not recommended. High resolution, exact mass data is always preferred when complete confidence is required in the formula assignment; however, the presence of certain isotropic elements must be supported by the cluster data. GRA

N92-15593# Defense Logistics Agency, Alexandria, VA. Operations Research and Economic Analysis Office.
THE REVIC ADVISOR (REVAD): AN EXPERT SYSTEM PREPROCESSOR TO A PARAMETRIC SOFTWARE COST ESTIMATING MODEL Final Report
Alan R. Greve, Richard M. Silla, Keith D. Ernst, and Dennis L. Skoneczka Sep. 1991 41 p
(AD-A242707; DLA-91-P81109) Avail: NTIS HC/MF A03
CSCL 12/5

Defense Contract Management Command (DCMC) engineers perform a Technical Analysis of a Cost Proposal (TACP) whenever a contractor submits a proposal in an environment of little or no competition. This environment applies to most weapons systems software proposals. The Department of Defense purchased an estimated $34 billion of software embedded in weapons systems in fiscal year 1990. Tools are needed to assist DCMC engineers in performing TACPs involving software. REVAD, coupled with REVIC, provides a flexible analytical framework from which the engineer may follow the analysis wherever it may lead. In addition to expert decision rules and an online software glossary, REVAD produces a complete report of the software cost estimating session, which the engineer may include in the TACP report. Based on the favorable results of a field test and the potential of huge savings from more effective TACPs involving software, DCMC should distribute REVAD throughout the command as a tool for software estimating. GRA

N92-15594# Naval Postgraduate School, Monterey, CA.
AN INVESTIGATION OF NONLINEAR CONTROLS AND REGRESSION-ADJUSTED ESTIMATORS FOR VARIANCE REDUCTION IN COMPUTER SIMULATION Ph.D. Thesis
Richard L. Ressler Mar. 1991 171 p
(AD-A242716) Avail: NTIS HC/MF A08 CSCL 12/5

This dissertation develops new techniques for variance reduction in computer simulation. It demonstrates that applying nonlinear transformations to control variables can increase their effectiveness over linear controls. It shows how one can reduce the variance of quantile estimates, where the quantile of interest is a continuous and strictly monotone transformation of the control quantile, by transforming the control quantile with a different continuous and strictly monotone transformation. Asymptotic expansions are developed to validate the improved performance of the nonlinear control for the quantile estimate. Finally, in the realm of regenerative simulation, regression-adjusted techniques are applied to controlled regenerative estimates. The resulting estimates have a greatly reduced estimated mean square error.
Author (GRA)

N92-15595# SRI International Corp., Menlo Park, CA.
DATA DRIVEN SPATIAL REASONING Annual Report, 1 Oct. 1990 - 30 Sep. 1991
Prasanna Mulgaonkar Oct. 1991 8 p
(Contract N00014-90-C-0063)
(AD-A242727; SRI-ITAD-8842-AR-91-143) Avail: NTIS HC/MF A02 CSCL 05/8

Our research is aimed at the development of computational techniques for hypothesizing the shapes of hidden portions of unknown objects within a pile of such objects, using a dense range image of the pile. The techniques that we have developed employ symmetry, stability, viewpoint independence, and object impenetrability to hypothesize the unknown shape and dimensions of each visible object. The process constructs alternative hypotheses, which differ in the way the visible portions of objects are extended into the occluded regions within the scene. To ensure that each interpretation is consistent with the observed range data, the known geometry of the range sensor is used in forming the hypotheses. The final result is one or more hypothesized object configurations, each of which is consistent with both the sensed range data and the physical constraints between objects in contact. GRA

N92-15596# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Sciences.
ON THE INTEGRATION OF DATA AND MATHEMATICAL MODELING LANGUAGES
Hemant K. Bhargava, Ramayya Krishnan, and Sumitra Mukherjee (Carnegie-Mellon Univ., Pittsburgh, PA.) 26 Sep. 1991 41 p

(AD-A242733; NPS-AS-91-05) Avail: NTIS HC/MF A03 CSCL 12/4

This paper examines ways in which the addition of data modeling features can enhance the capabilities of mathematical modeling languages, and demonstrates how such integration might be achieved as an application of the embedded languages technique proposed by Bhargava and Kimbrough. Decision making, and decision support systems, require the representation and manipulation of both data and mathematical models. Several data modeling languages as well as several mathematical modeling languages exist, but they have differences sets of capabilities. We motivate with a detailed example the need for the integration of these languages. We describe the benefits that might result, and claim that this could lead to a significant improvement in the functionality of model management systems. Then we present our approach for the integration of these languages, and specify how the claimed benefits are realized. GRA

N92-15597# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Sciences.

REASONING WITH ASSUMPTIONS, DEFEASIBLY, IN MODEL FORMULATION

Hemant K. Bhargava and Ramayya Krishnan (Carnegie-Mellon Univ., Pittsburgh, PA.) 4 Oct. 1991 12 p

(AD-A242734; NPS-AS-91-04) Avail: NTIS HC/MF A03 CSCL 12/9

This paper examines the relevance of reasoning with assumptions in two processes that are desired to be supported in model management systems, namely model formulation and model version management. We submit, and illustrate with an example, that the ability to represent and reason with assumptions in modeling languages could lead to significant improvement in the functionality of model management systems. We also argue that the process of reasoning with assumptions is non-monotonic and propose that defeasible reasoning is a useful candidate for modeling this process. GRA

N92-15598# Brown Univ., Providence, RI. Dept. of Computer Science.

PARALLEL ALGORITHMS WITH PROCESSOR FAILURES AND DELAYS

Jonathan F. Buss, Paris C. Kanellakis, Prabhakar L. Radge, and Alex A. Shvartsman 1 Aug. 1991 37 p

(Contract N00014-91-J-1613; NSF IRI-86-17344)

(AD-A242764; CS-91-54) Avail: NTIS HC/MF A03 CSCL 12/6

We study efficient deterministic parallel algorithms on two models: restartable fail-stop CRCW PRAMs and strongly asynchronous PRAMs. In the first model, synchronous processors are subject to arbitrary stop failures and restarts determined by an on-line adversary and involving loss of private but not shared memory; the complexity measures are completed work (where processors are charged for completed fixed-size update cycles) and overhead ratio (completed work amortized over necessary work and failure). In the second model, the result of the computation is a serialization of the actions of the processors determined by an on-line adversary; the complexity measure is total work (number of steps taken by all processors). Despite their differences the two models share key algorithmic techniques. We present new algorithms for the Write-All problem (in which P processors write ones into an array of size N) for these two models. These algorithms can be used to implement a simulation strategy for any N processor PRAM on a restartable fail-stop P processor CRCW PRAM such that it guarantees a terminating execution of each simulated N processor step, with O(log sq N) overhead ratio. GRA

N92-15599# Army Engineer Waterways Experiment Station, Vicksburg, MS. Information Technology Lab.

COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT: APPLICATION OF FINITE ELEMENT, GRID GENERATION, AND SCIENTIFIC VISUALIZATION TECHNIQUES TO 2-D AND 3-D SEEPAGE AND GROUNDWATER MODELING Final Report

Fred T. Tracy Sep. 1991 257 p

(AD-A242771; WES/ITL-91-3) Avail: NTIS HC/MF A12 CSCL 08/8

This report describes new advances in the computational modeling of ground water and seepage using the finite element method (FEM) in conjunction with tools and techniques typically used by the aerospace engineers. The unsolved environmental issues regarding our hazardous and toxic waste problems must be resolved, and significant resources must be placed on this effort. Some military bases are contaminated with hazardous waste that has entered the groundwater domain. A groundwater model that takes into account contaminant flow is therefore critical. First, an extension of the technique of generating an orthogonal structured grid (using the Cauchy-Riemann equations) to automatically generate a flow net for two-dimensional (2-D) steady-state seepage problems is presented for various boundary conditions. Second, a complete implementation of a three-dimensional (3-D) seepage package is described where (1) grid generation is accomplished using the EAGLE program, (2) the seepage and groundwater analysis for either confined or unconfined steady-state flow, homogeneous or inhomogeneous media, and isotropic or anisotropic soil is accomplished with no restriction on the FE grid or requirement of an initial guess of the free surface for unconfined flow problems, and (3) scientific visualization is accomplished using the program FAST developed by NASA. GRA

N92-15600# Stanford Univ., CA. Computer Systems Lab.

TECHNIQUES FOR THE DESIGN AND IMPLEMENTATION OF HIGHLY RELIABLE MULTI-PROCESSING SYSTEMS Final Report, 1 Apr. 1987 - 31 Jul. 1991

David C. Luckham Jul. 1991 11 p

(Grant AF-AFOSR-0150-87)

(AD-A242772; AFOSR-91-0923TR) Avail: NTIS HC/MF A03 CSCL 12/5

This research focuses on specification languages for multi-processor systems, with particular emphasis on applications to Ada software. The research, however, applies generally to specifying distributed systems containing both software and hardware components, and to software systems implemented in any programming language. The primary goals are (1) design of a high level specification language for distributed systems, and (2) design and development of prototype tools for applying this language to development of highly reliable multi-processor Ada software. GRA

N92-15601# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (Germany, F.R.).

Ada COMPILER VALIDATION SUMMARY REPORT: CERTIFICATE NUMBER: 910625I1.11193 ALSYS, ALSYSCOMP 057 VERSION 1.83, DECSTATION 3100 UNDER ULTRIX VERSION 4.0 HOST AND TARGET Final Report

28 Jun. 1991 77 p

(AD-A242780; IABG-VSR-097) Avail: NTIS HC/MF A05 CSCL 12/5

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The

information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. GRA

N92-15602# New York Univ., New York. Inst. of Mathematical Sciences.
IMPLEMENTATION AND EXPERIMENTATION WITH MOTION PLANNING ALGORITHMS Annual Report, 1 Oct. 1990 - 30 Sep. 1991
Micha Sharir Sep. 1991 16 p
(Contract N00014-90-J-1284)
(AD-A242801) Avail: NTIS HC/MF A03 CSCL 12/9

The main charter of this contract is the implementation and experimentation with motion planning algorithms that emphasize the exact combinatorial and purely geometric approach. Motion planning is considered to be one of the major research areas in robotics, and is one of the main stages in the design and implementation of autonomous intelligent systems, which is an important long-range goal in robotics research. Motion planning is one of the basic capabilities that such a system must possess. In purely geometric terms, the simplest version of the problem can be stated as follows. The system is given complete information about the geometry of the environment in which it is to operate (and of its own structure), and has to process it so that, when commanded to move from its current position to some target position, it can determine whether it can do so without colliding with any of the obstacles around it, and if so plan (and execute) such a motion. These are many variants of the problem. A few of those are: motion planning in environments that are only partially known to the system, compliant motion planning that allows contact with obstacles, which might be unavoidable due to measurement errors, optimal motion planning, motion planning with kino-dynamic constraints, and motion planning amidst moving obstacles. Still, even the simplest, static, and purely geometric version stated above is far from being simple, and poses serious challenges in the design of efficient and robust algorithms. GRA

N92-15603# Cornell Univ., Ithaca, NY.
A PROGRAM OF CONTINUING RESEARCH ON REPRESENTING, MANIPULATING, AND REASONING ABOUT PHYSICAL OBJECTS Annual Report, 1 Oct. 1990 - 30 Sep. 1991
John E. Hopcroft 30 Sep. 1991 13 p
(Contract N00014-89-J-1946)
(AD-A242808) Avail: NTIS HC/MF A03 CSCL 12/5

The Cornell Computer Science Modeling and Simulation Project was founded on the belief that electronic prototypes would have a significant impact on our nation's technological growth. From the project's inception, members of the research team have focused their attention on the investigation of fundamental computer science principles that underlie real-world representations. Our overriding objective is to develop a science base that supports electronic simulation systems to be used in computer aided design and engineering analysis. To this end, we are carrying out a broad-based research program to develop the underlying methodology that supports representation, editing, and simulation of objects, tasks, and systems. In our original proposal, we stressed three areas of research: solid modeler robustness, user friendly modeling systems, and control of complex objects. Results in each of these areas are summarized below. GRA

N92-15604*# Computer Sciences Corp., Hampton, VA.
TECHNICAL REQUIREMENTS ANALYSIS AND CONTROL SYSTEMS (TRACS) INITIAL OPERATING CAPABILITY (IOC) DOCUMENTATION
Dana P. Hammond Nov. 1991 35 p
(Contract NAS1-19038)
(NASA-CR-189557; NAS 1.26:189557) Avail: NTIS HC/MF A03 CSCL 09B

The Technical Requirements Analysis and Control Systems (TRACS) software package is described. TRACS offers supplemental tools for the analysis, control, and interchange of project requirements. This package provides the fundamental capability to analyze and control requirements, serves a focal point for project requirements, and integrates a system that supports efficient and consistent operations. TRACS uses relational data base technology (ORACLE) in a stand alone or in a distributed environment that can be used to coordinate the activities required to support a project through its entire life cycle. TRACS uses a set of keyword and mouse driven screens (HyperCard) which imposes adherence through a controlled user interface. The user interface provides an interactive capability to interrogate the data base and to display or print project requirement information. TRACS has a limited report capability, but can be extended with PostScript conventions. Author

N92-15605*# Computer Sciences Corp., Hampton, VA.
TADPLOT PROGRAM, VERSION 2.0: USER'S GUIDE Final Report
Dana P. Hammond Nov. 1991 122 p
(Contract NAS1-19038)
(NASA-CR-189553; NAS 1.26:189553) Avail: NTIS HC/MF A06 CSCL 09B

The TADPLOT Program, Version 2.0 is described. The TADPLOT program is a software package coordinated by a single, easy-to-use interface, enabling the researcher to access several standard file formats, selectively collect specific subsets of data, and create full-featured publication and viewgraph quality plots. The user-interface was designed to be independent from any file format, yet provide capabilities to accommodate highly specialized data queries. Integrated with an applications software network, data can be assessed, collected, and viewed quickly and easily. Since the commands are data independent, subsequent modifications to the file format will be transparent, while additional file formats can be integrated with minimal impact on the user-interface. The graphical capabilities are independent of the method of data collection; thus, the data specification and subsequent plotting can be modified and upgraded as separate functional components. The graphics kernel selected adheres to the full functional specifications of the CORE standard. Both interface and postprocessing capabilities are fully integrated into TADPLOT. Author

N92-15606*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
EFFECTS OF PARTITIONING AND SCHEDULING SPARSE MATRIX FACTORIZATION ON COMMUNICATION AND LOAD BALANCE Final Report
Sesh Venugopal and Vijay K. Naik (International Business Machines Corp., Yorktown Heights, NY.) Oct. 1991 21 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189563; NAS 1.26:189563; ICASE-91-80) Avail: NTIS HC/MF A03 CSCL 09B

A block based, automatic partitioning and scheduling methodology is presented for sparse matrix factorization on distributed memory systems. Using experimental results, this technique is analyzed for communication and load imbalance overhead. To study the performance effects, these overheads were compared with those obtained from a straightforward 'wrap mapped' column assignment scheme. All experimental results were obtained using test sparse matrices from the Harwell-Boeing data set. The results show that there is a communication and load balance tradeoff. The block based method results in lower communication cost whereas the wrap mapped scheme gives better load balance. Author

N92-15607*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
MASSIVELY PARALLEL ALGORITHMS FOR TRACE-DRIVEN CACHE SIMULATIONS Final Report
David M. Nicol, Albert G. Greenberg, and Boris D. Lubachevsky (Bell Telephone Labs., Inc., New York, NY.) Nov. 1991 23 p Submitted for publication

(Contract NAS1-18605; NAG1-1132; NSF ASC-88-19373)
(NASA-CR-189571; NAS 1.26:189571; ICASE-91-83) Avail: NTIS HC/MF A03 CSCL 09B

Trace driven cache simulation is central to computer design. A trace is a very long sequence of reference lines from main memory. At the t(exp th) instant, reference x sub t is hashed into a set of cache locations, the contents of which are then compared with x sub t. If at the t sup th instant x sub t is not present in the cache, then it is said to be a miss, and is loaded into the cache set, possibly forcing the replacement of some other memory line, and making x sub t present for the (t+1) sup st instant. The problem of parallel simulation of a subtrace of N references directed to a C line cache set is considered, with the aim of determining which references are misses and related statistics. A simulation method is presented for the Least Recently Used (LRU) policy, which regradless of the set size C runs in time O(log N) using N processors on the exclusive read, exclusive write (EREW) parallel model. A simpler LRU simulation algorithm is given that runs in O(C log N) time using N/log N processors. Timings are presented of the second algorithm's implementation on the MasPar MP-1, a machine with 16384 processors. A broad class of reference based line replacement policies are considered, which includes LRU as well as the Least Frequently Used and Random replacement policies. A simulation method is presented for any such policy that on any trace of length N directed to a C line set runs in the O(C log N) time with high probability using N processors on the EREW model. The algorithms are simple, have very little space overhead, and are well suited for SIMD implementation. Author

N92-15608# Japan Atomic Energy Research Inst., Tokyo.
SPEEDUP OF MCACE, A MONTE CARLO CODE FOR EVALUATION OF SHIELDING SAFETY, BY PARALLEL COMPUTER. 1: PARALLELING OF MCACE CODE AND PERFORMANCE EVALUATION BY SIMULATOR
Akemi Kawazoe, Kazuyoshi Minami (Fujitsu Ltd., Tokyo, Japan), Makoto Takano, Fumihiro Masukawa, and Yoshitaka Naito Apr. 1991 83 p In JAPANESE; ENGLISH summary
(DE91-508295; JAERI-M-91-066) Avail: NTIS HC/MF A05

In order to improve the accuracy of shielding analysis, we have modified MCACE, a Monte Carlo code for shielding analysis, to enable execution on a parallel computer. The suitable algorithms for efficient paralleling has been investigated by static and dynamic analyses of the code. This includes a strategy where new units of batches are assigned to the idling cells dynamically during the execution. The efficiency of paralleling has been measured by using a simulator of a parallel computer. It is found that the load factor of all cells reached nearly 100 percent, and consequently, it can be said that the most effective paralleling has been achieved. The simulator has estimated the effect of paralleling, at a speedup of 7.13 times, when a sample problem of 8 batches, 400 particles per one batch, is loaded on a parallel computer equipped with 8 cells. DOE

N92-15609# Centro Tecnico Aerospacial, San Jose dos Campos (Brazil). Inst. de Estudos Avancados.
GPIB INTERFACE OF IBM-PC COMPATIBLE MICROCOMPUTER AND MULTIMETER HP3457A FOR THE AUTOMATIZATION OF TEMPERATURE MEASUREMENTS
A. C. C. Migliano, F. SircilliNeto, and A. Passaro 1990 22 p In PORTUGUESE; ENGLISH summary
(DE91-642349; CTA-IEAV-001/90) Avail: NTIS HC/MF A03

The measurement of temperature distribution of the beam transport devices, utilized in the Institute for Advanced Studies (IEAv) (Brazil) linac, takes several hours to be completed. At the beam transport laboratory, these experiments are controlled with the help of a MS-quick BASIC code denominated TERMOJ. This code uses the software of STD-8410 plate to promote the communication between an IBM-PC compatible microcomputer and the programmable multimeter HP3457A via a general purpose interface bus (GPIB) interface. This work presents information for the automation of experiments using thermocouples to obtain temperature distributions with the TERMOJ code. Also, suggestions on how to modify the algorithm of the program for the specific situations are indicated. DOE

N92-15610# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
PAGE: A PROGRAM FOR GAMMA SPECTRA ANALYSIS IN PC MICROCOMPUTERS
M. A. Goncalves, M. Yamaura, G. J. C. Costa, E. I. deCarvalho, H. T. Matsuda, and B. F. deAraujo Apr. 1991 13 p In PORTUGUESE; ENGLISH summary
(DE91-642659; IPEN-PUB-333) Avail: NTIS HC/MF A03

PAGE is a software package, written in BASIC language, to perform gamma spectra analysis. It was developed to be used in a high-purity intrinsic germanium detector-multichannel analyzer-PC microcomputer system. The analysis program of the PAGE package accomplishes functions as follows: peak location; gamma nuclides identification; activity determination. Standard nuclides sources were used to calibrate the system. To efficiently perform the x energy calibration, a logarithmic fit was applied. Analysis of nuclides with overlapping peaks is allowed by the PAGE program. PAGE has additional auxiliary programs for building and listing isotopic nuclear data libraries; data acquisition from multichannel analyzer; spectrum display with automatic area and FWHM determinations. This software is to be applied in analytical process control where time response is a very important parameter. PAGE takes ca. 1.5 minutes to analyze a complex spectrum from a 4096 channel MCA. DOE

N92-15611# Oak Ridge Y-12 Plant, TN.
CHOOSING AND IMPLEMENTING A COMPUTER SYSTEM FOR PLANT LUBRICATION: NINE STEPS TO SUCCESS
J. C. Nook 3 Apr. 1991 10 p
(Contract DE-AC05-84OS-21400)
(DE92-002532; Y/CM-0268) Avail: NTIS HC/MF A02

Rapid advances in computer software offer may opportunities for increasing efficiency and productivity; however, choosing the right software package and achieving its full potential can be a challenging task. Lubrication engineers faced with the selection and implementation of a computer system will find that they can increase their chance of success when they follow the nine steps outlined in this paper. These steps provide a solid framework for managing the project through its full life-cycle from initial conception until final retirement of the system. Lubrication departments that already have computer systems in place can also benefit from these steps by picking up at the corresponding point in the system's life and following the remaining steps. DOE

N92-15085*# Mechanical Technology, Inc., Latham, NY.
KBS DEVELOPMENT
Bharat Aggarwal *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 41-46 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 09B

N92-15086*# Mechanical Technology, Inc., Latham, NY.
KBS DEMONSTRATION
Bharat Aggarwal, Antonio Artiles, and William Shapiro *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 47-50 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 09B

N92-15104*# Yosemite Systems, Inc., Alexandria, VA.
VOLUME VISUALIZATION AND KNOWLEDGE INTEGRATION Abstract Only
Thomas Cochrane *In* NASA. Lewis Research Center, Seals Flow Code Development Mar. 1991 p 171 (For primary document see N92-15082 06-16)
Avail: NTIS HC/MF A08 CSCL 09B

N92-15853*# Niagra Univ., New York, NY. Dept. of Computer and Information Sciences.
DATA SIMULATION FOR THE LIGHTNING IMAGING SENSOR (LIS)
William L. Boeck *In* Alabama Univ., Research Reports: 1991

NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

N92-15867*# Auburn Univ., AL. Dept. of Electrical Engineering.
NUMERICAL METHODS FOR THE ANALYSIS OF SAMPLED-DATA SYSTEMS AND FOR THE COMPUTATION OF SYSTEM ZEROS
A. Scottedward Hodel *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

N92-15870*# City Univ. of New York, Bronx. Dept. of Engineering Technologies.
DEVELOPMENT OF A CALIBRATED SOFTWARE RELIABILITY MODEL FOR FLIGHT AND SUPPORTING GROUND SOFTWARE FOR AVIONIC SYSTEMS
Stella Lawrence *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

N92-15885*# West Virginia Inst. of Tech., Montgomery. Dept. of Electrical Engineering.
SEDS1 MISSION SOFTWARE VERIFICATION USING A SIGNAL SIMULATOR
William E. Pierson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N92-15612# Sandia National Labs., Albuquerque, NM.
THE IMPLEMENTATION OF A STANDARDS BASED HETEROGENEOUS NETWORK
J. M. Eldridge and L. F. Tolendino Aug. 1991 18 p
(Contract DE-AC04-76DP-00789)
(DE92-000608; SAND-91-1168) Avail: NTIS HC/MF A03

Computer networks, supporting an organization's activities, are prevalent and very important to the organization's mission. Implementing a heterogenous organizational network allows the staff to select the computing environment that best supports their job requirements. This paper outlines the lessons learned implementing a heterogenous computer network based on networking standards such as Transmission Control Protocol/Internet Protocol (TCP/IP) and Ethernet. Such a network is a viable alternative to a proprietary, vendor supported network and can provide all the functionality customers expect in a computer network. DOE

N92-15613# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
KNOWLEDGE GRAPHS
P. James Mar. 1991 29 p
(MEMO-945; ISSN-0169-2690; ETN-92-90338) Avail: NTIS HC/MF A03

A knowledge graph is a kind of semantic network. The development of the project knowledge graphs is discussed. Structuring knowledge extracted from texts was considered. Using a very restricted set of types of relations between concepts, graphs were constructed that represent the extracted knowledge. These graphs were then combined, and the resulting graph was investigated with respect to its relevant substructures. This process was implemented in a program named KISS. An account of the various parts of this program is given. The presentation abilities of knowledge graphs was considered. An obvious challenge is the representation of natural language. This has led to an extension of the number of types of relations and to a comparison of knowledge graphs with other representational techniques. Current opinion on the issue of knowledge representation is discussed. ESA

N92-15614*# Cornell Univ., Ithaca, NY. Dept. of Computer Sciences.
DESIGN ALTERNATIVES FOR PROCESS GROUP MEMBERSHIP AND MULTICAST
Kenneth P. Birman, Robert Cooper, and Barry Gleeson Dec. 1991 33 p Revision of TR91-1185 (Jan. 1991) Sponsored in part by UNISYS Corp., San Jose, CA
(Grant NAG2-593)
(NASA-CR-189517; NAS 1.26:189517; TR91-1257) Avail: NTIS HC/MF A03 CSCL 09B

Process groups are a natural tool for distributed programming, and are increasingly important in distributed computing environments. However, there is little agreement on the most appropriate semantics for process group membership and group communication. These issues are of special importance in the Isis system, a toolkit for distributed programming. Isis supports several styles of process group, and a collection of group communication protocols spanning a range of atomicity and ordering properties. This flexibility makes Isis adaptable to a variety of applications, but is also a source of complexity that limits performance. This paper reports on a new architecture that arose from an effort to simplify Isis process group semantics. Our findings include a refined notion of how the clients of a group should be treated, what the properties of a multicast primitive should be when systems contain large numbers of overlapping groups, and a new construct called the casuality domain. As an illustration, we apply the architecture to the problem of converting processes into fault-tolerant process groups in a manner that is 'transparent' to other processes in the system. Author

N92-15615# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
PARALLEL RECOGNIZING IN PRACTICE: A WORKING PAPER
J. Hoogerbrugge and J. P. M. deVreught 1991 53 p Sponsored by TNO/ITI, Delft, Netherlands
(Rept-91-26; ISSN-0922-5641; ETN-92-90405) Copyright Avail: NTIS HC/MF A04

The use of parsing in formal language theory and natural language processing to find the justification of why a word or a sentence is in the given language is addressed. The problem is reformulated in a more formal way and three algorithms are presented. Experiences in trying to parallelize these algorithms on a parallel machine consisting of 16 processors are summarized. ESA

N92-15616# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
DYNAMIC PARALLEL QUERY PROCESSING
C. A. vandenBerg, M. L. Kersten, and S. Shair-Ali Feb. 1991 17 p
(CWI-CS-R9112; ETN-92-90552) Copyright Avail: NTIS HC/MF A03

Traditional query optimizers for multiprocessor database systems produce a mostly fixed query evaluation plan based on assumptions about data distribution and processor workloads. However, these assumptions may not hold at query execution time due to contention caused by concurrent use of the system or lack of precision in the derivation of the query plan. A dynamic query processing scheme based on subdividing the query into subtasks and scheduling these adequately at run time is proposed. The performance results obtained by simulation of a queuing network model of the poposed software architecture and the results from a validation of the simulations on the PRISMA 100 node multiprocessor are presented. ESA

N92-15617# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
A PROOF THEORY FOR PROCESS CREATION
Pierre H. M. America (Philips Gloeilampenfabrieken N.V., Amsterdam, Netherlands) and Frank S. deBoer Mar. 1991 87 p Sponsored by Netherlands Organization for Applied Scientific Research TNO
(CWI-CS-R9119; ETN-92-90558) Copyright Avail: NTIS HC/MF A05

A Hoare style proof system for a parallel language with process creation is developed. One of the main objectives of the proof system is to formalize reasoning about dynamically evolving process structures at an abstraction level at least as high as that of the programming language. ESA

N92-15618 Politecnico di Milano (Italy). Dipartimento di Elettronica.
A PARALLEL DISTRIBUTED ENVIRONMENT FOR GENETICS-BASED MACHINE LEARNING
Marco Dorigo and Enrico Sirtori Apr. 1991 24 p Sponsored in part by CNR
(Rept-91-015; ETN-92-90719) Avail: Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

An implementation of a Genetic Based Machine Learning (GBML) system on a transputer system, using EXPRESS (a set of functions derived from Parallel C), is presented. A design in which two levels of parallelism coexist is provided. The transputer network is divided into subsets, and on each subset a GBML system is implemented. The GBML is a recent approach to machine learning problems. In this model, a learning system is a set of rules on which two algorithms are applied: the genetic algorithm, whose task is to discover new useful rules, and the bucket brigade algorithm, which tries to rate rules according to their perceived usefulness. The comprehension of this model is dependent on simulations. The present understanding indicates that even the solution of simple learning problems requires the use of a large set of rules, and suggests that real world application will be possible only by exploiting the power of parallel computers. ESA

N92-15619# California Univ., Los Angeles. Dept. of Materials Science and Engineering.
DISTRIBUTED PROBLEM SOLVING: ADAPTIVE NETWORKS WITH A COMPUTER INTERMEDIARY RESOURCE. INTELLIGENT EXECUTIVE COMPUTER COMMUNICATION
Interim Report, Oct. 1984 - Jun. 1988
John Lyman and Carla J. Conaway Jun. 1991 73 p
(Contract MDA903-84-C-0355)
(AD-A242797; ARI-RN-91-80) Avail: NTIS HC/MF A04 CSCL 12/7

This report presents a system concept for an intelligent executive. Specifically, the functional requirements of a distributed group of agents are analyzed, along with the characteristics of different forms of communication. The intelligent executive embodies guidelines for specifying an appropriate communication strategy given the problem environment and the informational requirements of the group. When employed within a distributed problem solving environment, the intelligent executive is expected to facilitate the solution to a problem by increasing communication efficiency and problem-solving capabilities of distributed agents. GRA

N92-15620*# National Aeronautics and Space Administration. Pasadena Office, CA.
NETWORK OF DEDICATED PROCESSORS FOR FINDING LOWEST-COST MAP PATH Patent
Silvio P. Eberhardt, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 10 Dec. 1991 9 p Filed 26 May 1989 Supersedes N90-10608 (28 - 1, p 107)
(NASA-Case-NPO-17716-1-CU; US-Patent-5,072,379; US-Patent-Appl-SN-357759; US-Patent-Class-364-402; Int-Patent-Class-G06F-15/20; Int-Patent-Class-G06G-7/48)
Avail: US Patent and Trademark Office CSCL 09B

A method and associated apparatus are disclosed for finding the lowest cost path of several variable paths. The paths are comprised of a plurality of linked cost-incurring areas existing between an origin point and a destination point. The method comprises the steps of connecting a purality of nodes together in the manner of the cost-incurring areas; programming each node to have a cost associated therewith corresponding to one of the cost-incurring areas; injecting a signal into one of the nodes representing the origin point; propagating the signal through the plurality of nodes from inputs to outputs; reducing the signal in magnitude at each node as a function of the respective cost of the node; and, starting at one of the nodes representing the destination point and following a path having the least reduction in magnitude of the signal from node to node back to one of the nodes representing the origin point whereby the lowest cost path from the origin point to the destination point is found.
Official Gazette of the U.S. Patent and Trademark Office

N92-15621# National Lab. for High Energy Physics, Tsukuba (Japan).
A NEW PROGRAMMING METHOD FOR MULTI-TASK MULTI-COMPUTER SYSTEM WITH LOCAL AREA NETWORK: OBJP
Hidetoshi Nakagawa Feb. 1991 81 p In JAPANESE; ENGLISH summary
(DE91-508201; KEK-90-20) Avail: NTIS HC/MF A05

At the KEK 12 GeV Proton Synchrotron (12GeV PS), the control computer system has been changed from the MELCOM-70 mini-computer system to VME-computer system, in which computers are connected with a local area network (LAN) called MAP (Manufacturing Automation Protocol). Before the replacement, a test control system with VME-computers was installed in the part of the control system. At the same time, a programming support environment called OBJP was implemented. The OBJP helps programmers to make real-time multi-computer application software. The OBJP is a PASCAL pre-processor, and it generates a PASCAL program from an OBJP source program. In the case of a small program like the sample in this paper, the ratio of program size (OBJP source / PASCAL source) is about 1 / 10. In this case, the OBJP source can be much simpler than the PASCAL source.Part 1 shows the idea of the OBJP. Part 2 shows how a PASCAL source is generated from an OBJP source. In part 3, the summary of the OBJP syntax is shown. DOE

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N92-15622# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
TRACKING CONTROL OF ROBOTS USING ONLY POSITION MEASUREMENTS
H. Berghuis, P. Loehnberg, and H. Nijmeijer Mar. 1991 9 p Sponsored by Netherlands Technology Foundation
(MEMO-944; ISSN-0169-2690; ETN-92-90337) Avail: NTIS HC/MF A02

An exponentially stable tracking controller for robots that is based on position measurements only is presented. The controller consists of a computed torque like control part together with an observer part that determines an estimate of the velocity signal. A nice property of this observer is its linearity, which is, in fact, a consequence of the linearization of the computed torque control part (in the ideal case). The stability proof of the controller is based on a lemma. Under fairly general conditions on the controller and observer gains, exponential stability of the closed loop system is proven. ESA

N92-15623# Naval Research Lab., Washington, DC.
MACHINE LEARNING SYSTEMS. PART 1: CONCEPT LEARNING FROM EXAMPLES WITH AQ15 AND RELATED SYSTEMS Final Report, 1989 - 1990
Diane F. Gordon and William M. Spears 30 Sep. 1991 28 p
(AD-A242472; NRL-9330-Pt-1) Avail: NTIS HC/MF A03 CSCL 12/5

This is the first in a series of reports designed to acquaint Navy and other military personnel with current software available for machine learning. By acquainting personnel with the available software, we encourage the applicability of learning systems. AQ15 is a concept learning system that has the advantages of user-definable parameters and easily readable output. GRA

N92-15624# Rome Air Development Center, Griffiss AFB, NY.
SUMMARY OF THE NORTHEAST ARTIFICIAL INTELLIGENCE CONSORTIUM (NAIC) Report, Sep. 1984 - Dec. 1989
Sharon M. Walter Sep. 1991 51 p
(AF Proj. 5581)
(AD-A242563; RL-TR-91-301) Avail: NTIS HC/MF A04 CSCL 12/9

The underlying goals leading to the development of the Northeast Artificial Intelligence Consortium (NAIC) were to upgrade and increase the volume of artificial intelligence (AI) research directed toward the improvement of Air Force C3I system capabilities, and to intensify the transfer of that research towards the solution of military problems. The approach took the form of a substantial technical research program with additional, desirable activities focused on education and technology transfer. The quality of technical research within the program ran the gamut from a few very high-quality efforts, to a more abundant number of mediocre efforts, to a few efforts of poor quality. Some of the successful work has been continued in follow-on projects and included in expanded programs focused on similar technical areas. The poor performance within some projects has been reflected in the reluctance of some Rome Lab and AFOSR Program Managers to support other long-term work within another consortium-type of program. Consortium educational activities were to include cooperative educational opportunities among member universities, aggressive faculty and student recruitment, expansion of educational programs for Rome Lab personnel, and an expansion of AI resources within member schools through active pursuit of additional government and industry benifactors. GRA

N92-15876*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.
CONTROL OF A FLEXIBLE BEAM USING FUZZY LOGIC
Claire L. McCullough *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N92-15625# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
ON COMPUTING EFFICIENCY OF MONTE-CARLO METHODS IN SOLVING DIRICHLET'S PROBLEM
P. A. Androsenko and V. L. Lomtev 1990 40 p In RUSSIAN; ENGLISH summary
(DE91-637276; FEI-2076) Avail: NTIS HC/MF A03

Algorithms of Monte-Carlo methods based on boundary random walks, and application of Fredholm's series, intended for the solution of stationary and non-stationary boundary values in Dirichlet's problem for the Laplace's equation, are presented. Descriptions are made of the code systems BRANDB, BRANDBT and BRANDF realizing the above algorithms and allowing the calculation of values of solution and its derivatives for three-dimensional geometrical systems. The results of computing experiments on solving a number of problems in the system with convex and non-convex geometries are presented, and conclusions are made on the computing efficiency of the methods involved. DOE

N92-15626# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A NOVEL METHOD TO SOLVE FUNCTIONAL DIFFERENTIAL EQUATIONS. APPLICATION TO QUANTUM FIELD THEORY
V. Tapia 1989 30 p
(DE91-633974; JINR-E-2-89-309) Avail: NTIS HC/MF A03

A method is presented to solve functional linear differential equations based on the fact that a functional linear differential equation is solved by a local differential equation containing variational derivatives with respect to the concerned fields. The solution of a variational differential equation will be a function containing the derivatives of the fields at all orders. In order to keep finite the order of the solution one must restrict the considerations to those functions which are polynomials in the highest-order derivatives of the fields with arbitrary functions of the lower-order derivatives as coefficients. Then functional differential equations reduce to a system of coupled partial differential equations for the coefficients. These results are applied to quantum field theory. The Schroedinger equation reduces to a system of coupled partial differential equations. This provides therefore a non-perturbative scheme for quantum field theory. The massless and the massive (Klein-Gordon) scalar fields are considered. DOE

N92-15627# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
THE SOLUTION OF LEAST SQUARES PROBLEMS BY STANDARD AND SVD CODES
V. I. Ilyushchenko and P. Kozma 1989 4 p
(DE91-635955; JINR-E-10-89-521) Avail: NTIS HC/MF A01

The method of singular value decomposition (SVD) is used to solve the least squares problem (Ax=b) in a general manner. This method produces the full set of searched for parameters, x. The only technical peculiarity of this method consists in transforming an initial analytical fitting formula into the appropriate design matrix, A. A combination of any SVD code with a standard one, e.g., MINUIT, provides a reliable tool to crosscheck the obtained results. DOE

N92-15628# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
NONLINEAR EVOLUTION EQUATIONS AND SOLVING ALGEBRAIC SYSTEMS: THE IMPORTANCE OF COMPUTER ALGEBRA
V. P. Gerdt, N. A. Kostov, and A. Yu. Zharkov (Saratov N. G. Chernyshevsky State Univ., Astrakhanskaya, USSR) 1989 16 p
(DE91-635951; JINR-E-5-89-624) Avail: NTIS HC/MF A03

The application of computer algebra to solve the nonlinear polynomial systems which arise in investigation of nonlinear evolution equations is studied. We consider several systems which are obtained in classification of integrable nonlinear evolution equations with uniform rank. Other polynomial systems are related with the finding of algebraic curves for finite-gap elliptic potentials of Lame type and generalizations. All systems under consideration are solved using the method based on construction of the Groebner basis for corresponding polynomial ideals. The computations have been carried out using computer algebra systems. DOE

N92-15629# European Organization for Nuclear Research, Geneva (Switzerland).
PROCEEDINGS OF THE 1989 CERN SCHOOL OF COMPUTING CONFERENCE
C. Verkerk, ed. 29 May 1990 357 p Conference held in Bad Herrenalb, Fed. Republic of Germany, 20 Aug. - 2 Sep. 1989
(DE91-625148; CERN-90-06; CONF-8908204) Avail: NTIS HC/MF A16

These proceedings contain written versions of lectures delivered at the 1989 CERN School of Computing and cover a variety of topics. Vector and parallel computing are the subjects of five papers: experience with vector processors in HEP; scientific computing with transputers; applications of large transputer arrays; neutral networks and neurocomputers; and Amdahl's scaling law. Data-acquisition and event reconstruction methods were covered in two series of lectures reproduced here: microprocessor-based data-acquisition systems for HERA experiments, and track and vertex fitting. Two speakers treated applications of expert systems: artificial intelligence and expert systems - applications in data acquisition, and application of diagnostic expert systems in the accelerator domain. Other lecture courses covered past and present computing practice: 30 years of computing at CERN and information processing at the Aerospace Institute in the Federal Republic of Germany. Other papers cover the contents of lectures on: HEPnet, where we are and where we are going; ciphering algorithms; integrated circuit design for supercomputers; GaAs versus Si, theory and practice; and an introduction to operating systems. DOE

N92-15630# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SCATTERING PROBLEM FOR FADDEEV EQUATIONS IN ADIABATIC REPRESENTATION
S. I. Vinitskij, V. M. Dubovik, B. L. Markovski, and A. A. Suzko 1989 15 p In RUSSIAN; ENGLISH summary
(DE91-635992; JINR-R-2-89-228) Avail: NTIS HC/MF A03

A constructive approach to the direct and inverse three-body scattering problem is formulated. It is based on a new adiabatic representation for the three-body wave functions using the correct boundary conditions via compact integral Faddeev equations. DOE

N92-15631# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
RECURSION OPERATORS FOR HIGHER ORDER SYMMETRIES OF THE FEDERBUSH MODEL
Paul H. M. Kersten Jan. 1991 17 p
(MEMO-930; ISSN-0169-2690; ETN-92-90330) Avail: NTIS HC/MF A03

From four nonlocal first order symmetries, constructed in a recent paper, four recursion operators for symmetries of the Federbush model are derived. A proof is given. ESA

N92-15632# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
HODGES-LEHMANN OPTIMALITY OF TESTS
Wilbert C. M. Kallenberg and Stavros Kourouklis (Ioannina Univ., Greece) Feb. 1991 16 p
(MEMO-939; ISSN-0169-2690; ETN-92-90332) Avail: NTIS HC/MF A03

Several references in current literature indicate that many tests are optimal in the sense of Hodges-Lehmann efficiency. It is argued that shrinkage of the acceptance regions of the tests to the null set in a coarse way is already enough to ensure optimality. This type of argument can be used to show optimality of Kolmogorov-Smirnov, Cramer-von Mises tests, rank tests, and likelihood ratios in exponential families. ESA

N92-15633# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
ON THE GAME CHROMATIC NUMBER OF SOME CLASSES OF GRAPHS
U. Faigle, W. Kern, H. Kierstead, and W. T. Trotter (Arizona State Univ., Tempe.) Apr. 1991 15 p
(MEMO-940; ISSN-0169-2690; ETN-92-90333) Avail: NTIS HC/MF A03

Consider the following two person game on the graph G. Players 1 and 2 move alternatingly. Each move consists in coloring a yet uncolored vertex of G properly using a prespecified set of colors. The game ends when some player can no longer move. Player 1 wins if all of G is colored. Otherwise Player 2 wins. What is the minimal number gamma(G) of colors such that Player 1 has a winning strategy? It is shown that gamma(T) is less than or equal to 4 for each tree T. It is proved that gamma(G) = 0(log G) for graphs G that are unions of k trees. Thus, in particular, gamma(G) = 0 (log G) for the class of planar graphs. Finally, we bound gamma(G) by 3 omega(G) - 2 for interval graphs G. The order of magnitude of gamma(G) can generally not be improved for k-fold trees. The problem remains open for planar graphs. ESA

N92-15634# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
LONG PATHS AND CYCLES IN TOUGH GRAPHS
H. J. Broersma, J. vandenHeuvel, H. J. Veldman, and H. A. Jung (Technische Univ., Berlin, Germany, F.R.) Mar. 1991 19 p
(MEMO-946; ISSN-0169-2690; ETN-92-90339) Avail: NTIS HC/MF A03

The length of longest cycles in t tough graphs is studied. It is shown that, for t tough graphs with t greater than 0, the situation is different. Roughly speaking, it is shown that the length of a longest path and a longest cycle in a t tough graph cannot be bounded by a constant depending on t only if the number of vertices to be arbitrarily large is allowed. ESA

N92-15635# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
A PROOF OF BALINSKI AND RUSSAKOFF'S CONJECTURE ON THE CONNECTIVITY OF ASSIGNMENT POLYTOPE
Li Xueliang (Xinjiang Univ., Urumchi, China) Mar. 1991 10 p
(MEMO-947; ISSN-0169-2690; ETN-92-90340) Avail: NTIS HC/MF A02

Graph theory and the connectivity of assignment polytopes is studied. A conjecture of Balinski and Russakoff on the connectivity of assignment of polytope, that G(P sub n) is N(n) connected, is proved. ESA

N92-15636# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
EVOLUTIONARY TREES: AN INTEGER MULTICOMMODITY MAX-FLOW-MIN-CUT THEOREM
Peter L. Erdoes and Laszlo A. Szekely (Eoetvoes Lorand Fizikai Tarsulat, Budapest, Hungary) Apr. 1991 21 p
(MEMO-953; ISSN-0169-2690; ETN-92-90346) Avail: NTIS HC/MF A03

In biomathematics, the extensions of a leaf coloration of a binary tree to the whole vertex set with minimum number of color changing edges are extensively studied. The problem for trees is generalized; algorithms and a Menger type theorem are presented. The LP dual of the problem is a multicommodity flow problem for which a max flow min cut theorem holds. The problem solved is an instance of the NP hard multiway cut problem. A graph theoretical conjecture that would imply NP = co-NP is posed. ESA

N92-15637# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
HAMILTONICITY OF A TYPE OF INTERCHANGE GRAPHS
Zhang Fuji and Li Xueliang (Xinjiang Univ., Urumchi, China) Apr. 1991 10 p
(MEMO-956; ISSN-0169-2690; ETN-92-90349) Avail: NTIS HC/MF A02

Let R = (r sub 1,...,r sub m) and S (s sub 1,...,s sub n) be two non-negative integral vectors, and let U(R,S) denote the class of all matrices of 0's and 1's having row sum vector R and column sum vector S. It is proved that when (s sub 1 = ... s sub n = 1) or (r sub 1 = ... = r sub m = 1), the interchange graph G(R,S) of U(R,S) possesses hamiltonicity. This gives a positive answer to a problem, posed by Brualdi, for a type of interchange graphs. ESA

N92-15638# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
AN ADDITION THEOREM AND SOME PRODUCT FORMULAS FOR THE HAHN-EXTON q-BESSEL FUNCTIONS

Rene F. Swarttouw 1990 22 p
(Rept-90-82; ISSN-0922-5641; ETN-92-90370) Copyright Avail: NTIS HC/MF A03

The derivation of an addition formula for q-bessel functions is described. Some formulas and notations are given, and a product formula for the Hahn-Exton q-Bessel functions is derived. An integral representation for a product of two q-Bessel functions is found with the aid of the Askey-Wilson integral. ESA

N92-15639# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
LIMIT CYCLES IN A CUBIC SYSTEM WITH A CUSP
Wang Xian (Nanjing Univ., China) and Robert E. Kooij 1991 21 p
(Rept-91-03; ISSN-0922-5641; ETN-92-90383) Copyright Avail: NTIS HC/MF A03

The number of limit cycles in a cubic system with a cusp is studied. By using new results concerning systems of the Lienard type, the question of relative position and the maximum number of limit cycles for this system is solved completely. ESA

N92-15640# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
CONDITIONAL RECURRENT SEQUENCES
T. H. M. Smits 1991 12 p
(Rept-91-07; ISSN-0922-5641; ETN-92-90387) Copyright Avail: NTIS HC/MF A03

A structural approach to a trialistic problem of recurrent sequence is given, expressing the problem in terms of an auxiliary sequence which satisfies a recurrence relation of lowest degree. In solving the three way model, a many way model is also solved by the same method. For reasons of clarity, the study is confined to the three way model. ESA

N92-15641# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
ZERO DISTRIBUTION OF ORTHOGONAL POLYNOMIALS IN A CERTAIN DISCRETE SOBOLEV SPACE
H. G. Meijer 1991 26 p
(PB91-218818; Rept-91-08; ISSN-0922-5641; ETN-92-90388) Copyright Avail: NTIS HC/MF A03

The zero distribution of the polynomials (S(sub n)(sup N)) which are orthogonal with respect to a discrete Sobolev inner product is studied. (S(sub n)(sup N)) has n real, simple zeros; at most, one of them is outside the product limits. The location of these zeros is given in relation to the position of the zeros of some classical polynomials (i.e., polynomials with respect to an inner product with N = 0). ESA

N92-15642# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
THE GEOMETRY OF JULIA SETS
Jan M. Aarts and Lex G. Oversteegen (Alabama Univ., Birmingham.) 1991 25 p
(Grant NSF RII-86-10669)
(Rept-91-10; ISSN-0922-5641; ETN-92-90390) Copyright Avail: NTIS HC/MF A03

The long term analysis of dynamical systems inspired the study of the dynamics of families of mappings. Many of these investigations led to the study of the dynamics of mappings on Cantor sets and on intervals. Julia sets play a critical role in the understanding of the dynamics of families of mappings. Another class of objects (called hairy objects) which share many properties with the Cantor set and the interval (they are topologically unique and admit only one embedding in the plane) is introduced. These uniqueness properties explain the regular occurrence of hairy objects in pictures of Julia sets: hairy objects are ubiquitous. Hairy arcs are used to give a complete topological description of the Julia sets of many members of the exponential family. ESA

N92-15643# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
LOGICAL SYSTEMS ARE GENERALISED TYPE SYSTEMS
Hans Tonino 30 Jan. 1991 34 p
(Rept-91-11; ISSN-0922-5641; ETN-92-90391) Copyright Avail: NTIS HC/MF A03

The Curry-Howard-De Brujin isomorphism between higher order many sorted intuitionistic predicate logic and a type system which can be considered as a subsystem of the calculus of constructions is described. The interpretation of formulae and proof trees of the logic as types and terms of the type system, respectively, is shown. The formal relationship of the type system and the full calculus of constructions is discussed. ESA

N92-15644# National Science Foundation, Washington, DC. Div. of Mathematical Sciences.
THE 1990 AWARDS IN COMPUTATIONAL MATHEMATICS, FISCAL YEAR 1990
1990 11 p
(NSF-90-135; CFDA-47049) Avail: NTIS HC/MF A03

This report lists the winners of the National Science Foundation 1990 awards in computational mathematics. Specific topics and university or other corporate affiliations are supplied for the recipients named. J.P.S.

N92-15645# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
MULTIPLE INTEGER LABELING AND FIXED POINT APPROXIMATION
Hans vanMaaren 1991 16 p
(Rept-91-21; ISSN-0922-5641; ETN-92-90401) Copyright Avail: NTIS HC/MF A03

Complementary pivoting algorithms are considered on the base of a modified form of Scarf's primitive sets. Here, the pivots are to be controlled by a new type of labeling. The analysis of the limiting stage provides a new variety of fixed point results, where the usual convexity assumptions are relaxed drastically. The results mentioned also connect separation and fixed point theory in a natural way and are even applicable outside the domain of linear spaces. Moreover, they focus on the differences between integer and vector labeling in a very accurate manner. ESA

N92-15646# Technische Univ., Delft (Netherlands). Faculty of Technical Mathematics and Informatics.
NOT ALL SIGMA-COMPLETE BOOLEAN ALGEBRAS ARE QUOTIENTS OF COMPLETE BOOLEAN ALGEBRAS
A. Dow (York Univ., Ontario) and J. Vermeer 1991 9 p
(Rept-91-28; ISSN-0922-5641; ETN-92-90407) Copyright Avail: NTIS HC/MF A02

The class of quotients of complete Boolean algebras are investigated as fundamental to the study of extremely disconnected spaces. Boolean algebras are addressed since the Boolean algebraic notions of completeness and sigma completeness are undoubtedly better known than the topological notions of extremely and basically disconnected spaces. ESA

N92-15647# Amsterdam Univ. (Netherlands). Inst. for Language, Logic and Information.
CYLINDRICAL MODAL LOGIC
Yde Venema Jan. 1991 36 p
(ITLI-ML-91-01; ISSN-0924-2090; ETN-92-90426) Avail: NTIS HC/MF A03

Cylindric algebras are studied from a perspective of modal logic. A completeness result for this modal logic yields a finite derivation system for the equations valid in the variety of representable cylindric algebras, and a proof calculus for type free valid formulas. ESA

N92-15648# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
INTERSECTION QUERIES IN CURVED OBJECTS
Pankaj K. Agarwal (Duke Univ., Durham, NC.), Marc vanKreveld, and Mark Overmars May 1991 32 p Sponsored by EEC, and Netherlands Organization for Scientific Research
(Grant NSF STC-88-09648)

(RUU-CS-91-12; ISSN-0924-3275; ETN-92-90476) Avail: NTIS HC/MF A03

A number of problems of the following type are studied: given a set of n arcs (disks, circles, circular arcs, Jordan arcs) in the plane, preprocess it into a data structure, such that for a query line (or segment) one can quickly report all arcs intersecting it, or count the number of arcs intersecting it. The ray shooting problem in disjoint Jordan arcs and circular arcs, is also studied. Most of the data structures presented use near to linear space and have query time near to O((square root of n) + K) or near to O((n exp 2/3) + K) where K is the size of the output. ESA

N92-15649# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research, Statistics, and System Theory.

RIGHT ANGLE FREE SUBSETS IN THE PLANE

B. Gamble, W. Pulleyblank, B. Reed (Waterloo Univ., Ontario), and B. Shepherd Apr. 1991 11 p Sponsored in part by Canadian Natural Sciences and Engineering Research Council (CWI-BS-R9110; ETN-92-90541) Copyright Avail: NTIS HC/MF A03

The complexity of finding maximum right angle free subsets in the plane is investigated. For a set of rational points (P) in the plane, the right angle number rho(P) (respectively rectilinear right angle number rho r(p)) of P is the cardinality of a maximum subset of P, no three members of which form a right angle triangle (respectively a right angle triangle with its side or base parallel to the x axis). It is shown that both parameters are NP hard to compute. The latter problem is also shown to be equivalent to finding a minimum dominating set in a bipartite graph. This is used to show that there is a polynomial algorithm for computing rho r(P) when P is a horizontally convex subset of the lattice Z by Z (P is horizontally convex if for any pair of points in P which lie on a horizontal line, every lattice point between them is also in P). This algorithm is shown to yield a 1/2 approximate algorithm for the right angle number of a convex subregion of the lattice. ESA

N92-15650# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.

COMPLETENESS IN REAL TIME PROCESS ALGEBRA

A. S. Klusener Jan. 1991 60 p Sponsored in part by EEC (CWI-CS-R9106; ETN-92-90546) Copyright Avail: NTIS HC/MF A04

Some machinery and a completeness result for an extension of the Algebra of Communicating Processes (ACP) with real time called ACP(rho) are given. The operational semantics of ACP(rho) contains the notion of an idle step reflecting that a process can do nothing more then pass the time before performing a concrete action at a certain point in time. This idle step corresponds nicely to the intuition, but it results in uncountable branching transition systems. A more abstract operational semantics is given by abstracting from the idle step. Due to this simplification, soundness and completeness can be proved. These results hold for the semantics of ACP(rho) as well, since both operational semantics induce the same equivalence relation between processes. ESA

N92-15651# International Centre for Theoretical Physics, Trieste (Italy).

ON THE MIXED PROBLEMS FOR PARABOLIC EQUATIONS

M. L. Morales Oct. 1990 19 p

(DE91-632245; IC-90/320) Avail: NTIS HC/MF A03

We consider the second and the third boundary value problems for linear parabolic equations in a cylindrical domain. Under assumption of Hoelder continuity of the coefficients of the equations only with respect to space variables, we establish the existence and uniqueness of the solution. This result is applied to obtain the solvability of these problems for nonlinear parabolic equations. The second derivatives with respect to chi of the corresponding solutions satisfy the Hoelder condition with respect to the space variables and with respect to the time. DOE

N92-15652# International Centre for Theoretical Physics, Trieste (Italy).

EXPLOSIVE AND GLOBAL SOLUTIONS FOR A CLASS OF 2X2 SEMILINEAR SYSTEMS OF DIFFERENTIAL EQUATIONS

T. Gramchev Oct. 1990 15 p

(DE91-632252; IC-90/351) Avail: NTIS HC/MF A03

The paper considers a class of 2x2 systems of ordinary and partial differential equations with nonlinear terms homogeneous polynomials. We show necessary and/or sufficient conditions for the existence of explosive and global solutions of the corresponding Cauchy problems. DOE

N92-15653# International Centre for Theoretical Physics, Trieste (Italy).

ON A THREE-SURFACE THEOREM FOR ELLIPTIC DIFFERENTIAL INEQUALITIES WITH NONPOSITIVE ZERO-ORDER COEFFICIENTS

Zhujia Lu Nov. 1990 6 p

(DE91-632258; IC-90/389) Avail: NTIS HC/MF A02

The three-surface theorem for uniformly elliptic differential inequalities with nonpositive coefficients of zero-order term in some domain D is a subset of R sup n becomes trivial if the maximum of u on two separate boundary surfaces of D is nonpositive. We give a method in this paper for obtaining a nontrivial estimate of the maximum of u on a family of closed surfaces. DOE

N92-15654# International Centre for Theoretical Physics, Trieste (Italy).

ON THE INVESTIGATION OF EVOLUTION OF DYNAMICAL SYSTEMS-2

V. G. Gurzadyan and A. A. Kocharyan (Academy of Sciences of the Armenian SSR, Erivan.) Nov. 1990 7 p

(DE91-632264; IC-90/331) Avail: NTIS HC/MF A02

A previously performed method enabling us to investigate the evolution of dynamical systems with an accuracy not dependent on time is developed further. The classes of dynamical systems which can be studied by that method are much extended, now including: (1) non-Hamiltonian, conservative; (2) Hamiltonian with time dependent perturbation; and (3) non-conservative (with dissipation). DOE

N92-15655# International Centre for Theoretical Physics, Trieste (Italy).

CLOSED TIME PATH GREEN'S FUNCTION AND ITS APPLICATIONS IN TRANSPORT THEORY

Zhaobin Su, Lu Yu, and Liaoyuan Chen (Houston Univ., TX.) Oct. 1990 22 p

(DE91-632267; IC-90/384) Avail: NTIS HC/MF A03

The closed time path Green's function (CTPGF) theory and its path integral formulation are reviewed. The quantum interference between different paths and the statistics (generally nonequilibrium) make the closed time path necessary where the causality requirement is automatically ensured. It is proven to be equivalent to the Feynman-Vernon influence functional approach but it has the advantage of being a systematic disentangling technique. For several fundamental problems of transport theory, by applying CTPGF, the time dependent Ginzburg-Landau equation for the macro-variables is a natural product of the micro-dynamics. The inconsistency between the force balance and the energy balance in the Thornber-Feynman transport problem is removed and the consistency is guaranteed by the nonequilibrium fluctuation-dissipation theorem. For transport in microstructures such as the tunneling transport across double barrier resonant tunneling structures, CTPGF method enables us to correctly treat all the essential ingredients of the problem: the reservoir effect, the nonperturbative tunneling coupling, and the nonequilibrium distribution of tunneling electrons. The frequency response in the negative differential resistance region and the noise characteristics are calculated and compared with experiments. DOE

N92-15656# International Centre for Theoretical Physics, Trieste (Italy).

CLASSICAL EXTENDED SUPERCONFORMAL SYMMETRIES
R. R. Viswanathan Oct. 1990 22 p
(DE91-632343; IC-90/374) Avail: NTIS HC/MF A03

Super-covariant differential operators are defined in two dimensions which map supersymmetry doublets to other doublets. The possibility of constructing a closed algebra among the fields appearing in such operators is explored. Such an algebra exists for Grassmann-odd differential operators. A representation for these operators in terms of free-field doublets is constructed. An explicit closed algebra involving fields of spin 2 and 5/2, in addition to the stress tensor and the supersymmetry generator, is constructed from such a free-field representation as an example of a nonlinear extended superconformal algebra. DOE

N92-15657# Naval Research Lab., Washington, DC.
PRINCIPLES OF INTERPOLATOR DESIGN AND EVALUATION Interim Report
Alan Schaum 15 Nov. 1991 44 p
(AD-A242822; NRL-9356) Avail: NTIS HC/MF A03 CSCL 12/1

It is shown that an error spectrum can be used to describe the performance of any convolutional interpolator operating on equally spaced points from an over sampled image. The error spectrum is linear in the image power spectrum and in an error factor that depends on only the interpolator and the distance from the sample points. The same form is shown to describe the interpolation of undersampled data, in an average sense. Simple forms are given for the error factor in either Fourier or real space, and standard interpolators are evaluated with them. Optimal interpolators are derived for various model image spectra: constant, Lorentzian, power law, and Gaussian. Practical methods of interpolator design are devised for use with image spectra that are known only partially or are not easily characterized analytically. GRA

N92-15658*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
APPROXIMATION METHODS FOR CONTROL OF ACOUSTIC/STRUCTURE MODELS WITH PIEZOCERAMIC ACTUATORS Final Report
H. T. Banks, W. Fang (California Univ., Los Angeles.), R. J. Silcox, and R. C. Smith Dec. 1991 31 p Submitted for publication
(Contracts NAS1-18605; NAS1-18107; NAG1-1116; AF-AFOSR-0091-90)
(NASA-CR-189578; NAS 1.26:189578; ICASE-91-88) Avail: NTIS HC/MF A03 CSCL 12A

The active control of acoustic pressure in a 2-D cavity with a flexible boundary (a beam) is considered. Specifically, this control is implemented via piezoceramic patches on the beam which produces pure bending moments. The incorporation of the feedback control in this manner leads to a system with an unbounded input term. Approximation methods in this manner leads to a system with an unbounded input term. Approximation methods in the context of linear quadratic regulator (LQR) state space control formulation are discussed and numerical results demonstrating the effectiveness of this approach in computing feedback controls for noise reduction are presented. Author

N92-15659*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
DESIGN OF AN ESSENTIALLY NON-OSCILLATORY RECONSTRUCTION PROCEDURE ON FINITE-ELEMENT TYPE MESHES Final Report
R. Abgrall (Institut National de Recherche d'Informatique et d'Automatique, Valbonne, France) Dec. 1991 35 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189574; NAS 1.26:189574; ICASE-91-84) Avail: NTIS HC/MF A03 CSCL 12A

An essentially non-oscillatory reconstruction for functions defined on finite-element type meshes was designed. Two related problems are studied: the interpolation of possibly unsmooth multivariate functions on arbitrary meshes and the reconstruction of a function from its average in the control volumes surrounding the nodes of the mesh. Concerning the first problem, we have studied the behavior of the highest coefficients of the Lagrange interpolation function which may admit discontinuities of locally regular curves. This enables us to choose the best stencil for the interpolation. The choice of the smallest possible number of stencils is addressed. Concerning the reconstruction problem, because of the very nature of the mesh, the only method that may work is the so called reconstruction via deconvolution method. Unfortunately, it is well suited only for regular meshes as we show, but we also show how to overcome this difficulty. The global method has the expected order of accuracy but is conservative up to a high order quadrature formula only. Some numerical examples are given which demonstrate the efficiency of the method. Author

N92-15660# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
FOUR-STATE SOLUTION OF THE YANG-BAXTER EQUATION
R. M. Kashaev and V. V. Mangazeev 1990 9 p Submitted for publication
(DE91-639743; IHEP-TD-90-73) Avail: NTIS HC/MF A02

A new four-state solution of the Yang-Baxter equation is constructed with the help of the lowest dimensional cyclic L-operator related to a 3-state R-matrix. Some special choice of parameters which this solution depends on, leads to the exactly solvable spin model on the chain with Hermitian Hamiltonian. DOE

N92-15661# Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil).
ARANHA: A 2D MESH GENERATOR FOR TRIANGULAR FINITE ELEMENTS
E. A. Fancello (Universidade Federal do Rio de Janeiro, Brazil), A. C. Salgado, and R. A. Feijoo 1990 19 p In PORTUGUESE; ENGLISH summary
(DE91-642775; LNCC-021/90) Avail: NTIS HC/MF A03

A method for generating unstructured meshes for linear and quadratic triangular finite elements is described in this paper. Some topics on the C language data structure used in the development of the program Aranha are also presented. The applicability for adaptive remeshing is shown and, finally, several examples are included to illustrate the performance of the method in irregular connected planar domains. DOE

N92-15662*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
OPTIMAL LEAST-SQUARES FINITE ELEMENT METHOD FOR ELLIPTIC PROBLEMS
Bo-Nan Jiang and Louis A. Povinelli Dec. 1991 18 p
(NASA Order C-99066-G)
(NASA-TM-105382; ICOMP-91-29; E-6769; NAS 1.15:105382)
Avail: NTIS HC/MF A03 CSCL 12A

An optimal least squares finite element method is proposed for two dimensional and three dimensional elliptic problems and its advantages are discussed over the mixed Galerkin method and the usual least squares finite element method. In the usual least squares finite element method, the second order equation (-Delta x (Delta u) + u = f) is recast as a first order system (-Delta x p + u = f, Delta u - p = 0). The error analysis and numerical experiment show that, in this usual least squares finite element method, the rate of convergence for flux p is one order lower than optimal. In order to get an optimal least squares method, the irrotationality Delta x p = 0 should be included in the first order system. Author

N92-15663*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
CENTRAL DIFFERENCE TVD AND TVB SCHEMES FOR TIME DEPENDENT AND STEADY STATE PROBLEMS
P. Jorgenson and E. Turkel (Tel-Aviv Univ., Israel) 1992 12 p Presented at the 30th Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992; sponsored by AIAA

(NASA Order C-99066-G)
(NASA-TM-105357; ICOMP-91-27; E-6734; NAS 1.15:105357; AIAA-92-0053) Avail: NTIS HC/MF A03 CSCL 12A

We use central differences to solve the time dependent Euler equations. The schemes are all advanced using a Runge-Kutta formula in time. Near shocks, a second difference is added as an artificial viscosity. This reduces the scheme to a first order upwind scheme at shocks. The switch that is used guarantees that the scheme is locally total variation diminishing (TVD). For steady state problems it is usually advantageous to relax this condition. Then small oscillations do not activate the switches and the convergence to a steady state is improved. To sharpen the shocks, different coefficients are needed for different equations and so a matrix valued dissipation is introduced and compared with the scalar viscosity. The connection between this artificial viscosity and flux limiters is shown. Any flux limiter can be used as the basis of a shock detector for an artificial viscosity. We compare the use of the van Leer, van Albada, mimmod, superbee, and the 'average' flux limiters for this central difference scheme. For time dependent problems, we need to use a small enough time step so that the CFL was less than one even though the scheme was linearly stable for larger time steps. Using a total variation bounded (TVB) Runge-Kutta scheme yields minor improvements in the accuracy. Author

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N92-15664# Stanford Univ., CA. Systems Optimization Lab.
MULTI-STAGE STOCHASTIC LINEAR PROGRAMS FOR PORTFOLIO OPTIMIZATION
George B. Dantzig and Gerd Infanger Sep. 1991 23 p
(Contract N00014-89-J-1659; NSF ECS-89-06260)
(AD-A242510; SU-SOL-91-11) Avail: NTIS HC/MF A03 CSCL 12/4

The paper demonstrates how multi-period portfolio optimization problems can be efficiently solved as multi-stage stochastic linear programs. A scheme based on a blending of classical Benders decomposition techniques and a special technique, called importance sampling, is used to solve this general class of multi-stage stochastic linear programs. We discuss the case where stochastic parameters are dependent within a period as well as between periods. Initial computational results are presented. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N92-15665# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
SPACE AND THE AIRLAND BATTLE M.S. Thesis
John S. Prall, Jr. 7 Jun. 1991 222 p
(AD-A242608) Avail: NTIS HC/MF A10 CSCL 22/2

This study investigates how well the potential of space technology is incorporated by the Army into its warfighting doctrine. The study examines the potential benefits of space systems for the military, focusing on Communications, Navigation, Reconnaissance and Surveillance, and Weather support. It evaluates which aspects of the warfighting doctrines, both AirLand Battle and its successor AirLand Battle Future, can be enhanced by the use of space systems. It describes the current Army space infrastructure and makes a determination as to its effectiveness in integrating space into the Army's day to day operations. The Army already uses space technology to some extent in its operations. Examples cited from America's recent conflicts, particularly those from Operation DESERT STORM, indicate that the Army recognizes the utility of space assets and is endeavoring to find ways to effectively use them. The study concludes that the Army should be tactical and operational user of space services, not a strategic operation of space systems, but that it does not yet fully accept that situation. Consequently, Army space operations remain somewhat unfocused, with emphasis shifting between support of national strategic requirements and the needs of the Army's operational and tactical level AirLand Battle commanders. GRA

N92-15666*# University of Central Florida, Orlando. Dept. of Industrial Engineering and Management Systems.
SYNCHRONIZATION OF AUTONOMOUS OBJECTS IN DISCRETE EVENT SIMULATION
Ralph V. Rogers [1990] 33 p
(Grant NAG2-625)
(NASA-CR-189534; NAS 1.26:189534) Avail: NTIS HC/MF A03 CSCL 12B

Autonomous objects in event-driven discrete event simulation offer the potential to combine the freedom of unrestricted movement and positional accuracy through Euclidean space of time-driven models with the computational efficiency of event-driven simulation. The principal challenge to autonomous object implementation is object synchronization. The concept of a spatial blackboard is offered as a potential methodology for synchronization. The issues facing implementation of a spatial blackboard are outlined and discussed. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N92-15667 Helsinki Univ. (Finland). Suomalainen Tiedeakatemia.
DECOMPOSITIONS OF TEICHMULLER SPACE BY GEODESIC LENGTH MAPPINGS Thesis
Chen Min and Olli Lehto, ed. 1991 35 p
(ISSN-0355-0087; ISBN-951-41-0663-6) Copyright Avail: Issuing Activity

The main purpose is the study of the behavior of some geodesic length mappings. It is shown that the Teichmuller space T sub p of a compact Riemann surface of genus p is greater than or equal to 2 can be divided into several connected open sets by some (real analytic) 6p - 7-dimensional submanifolds such that the geodesic length mappings are injective when restricted on each of these open sets. The orthogonal decomposition theory of hyperbolic Mobius transformations is also developed and applied to the theory of Teichmuller spaces. Author

N92-15668# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoj Ehnergii.
TRANSFORMATION OF A COVARIANT QUARK WIGNER OPERATOR TO A NONCOVARIANT ONE
A. V. Selikhov 1989 25 p
(DE91-623903; IAE-4725-1) Avail: NTIS HC/MF A03

The gauge in which covariant and noncovariant quark Wigner operators coincide has been found. In this gauge, the representations of vector potential via field strength tensor is valid. The system of equations for the coefficients of covariant Wigner operator expansion in the basis gamma-matrices algebra is obtained. DOE

N92-15669# International Centre for Theoretical Physics, Trieste (Italy).
MINIMAL SURFACES IN RIEMANNIAN MANIFOLDS
Min Ji and Guangyin Wang (Academia Sinica, Beijing, China) Oct. 1990 35 p
(DE91-632250; IC-90/343) Avail: NTIS HC/MF A03

A multiple solution to the Plateau problem in a Riemannian manifold is established. In S(sup n), the existence of two solutions to this problem is obtained. The Morse-Tompkins-Shiffman theorem

is extended to the case when the ambient space admits no minimal sphere. DOE

N92-15670# International Centre for Theoretical Physics, Trieste (Italy).
STABILITY OF THE SOLUTION SET OF PERTURBED NONSMOOTH INEQUALITY SYSTEMS
Dong Yen Nguyen Nov. 1990 22 p
(DE91-632254; IC-90/359) Avail: NTIS HC/MF A03

An extension of the stability theorem of S. M. Robinson to the case of the inequality systems given by local Lipschitz functions in finite-dimensional spaces is obtained. We are also interested in some stability properties of the solution set other than the estimation in Robinson's sense. DOE

N92-15671# International Centre for Theoretical Physics, Trieste (Italy).
ON TESTS OF RANDOMNESS FOR SPATIAL POINT PATTERNS
S. I. Doguwa Nov. 1990 22 p
(DE91-632256; IC-90/385) Avail: NTIS HC/MF A03

New tests of randomness for spatial point patterns are introduced. These test statistics are then compared in a power study with the existing alternatives. These results of the power study suggest that one of the tests proposed is extremely powerful against both aggregated and regular alternatives. DOE

N92-15672# International Centre for Theoretical Physics, Trieste (Italy).
SUPERSYMMETRIC RACAH BASIS, FAMILY OF INFINITE-DIMENSIONAL SUPERALGEBRAS, SU((INFINITY)+1(INFINITY)) AND RELATED 2D MODELS
E. S. Fradkin and V. Ya. Linetsky (Academy of Sciences, USSR, Moscow) Oct. 1990 24 p
(DE91-632257; IC-90/387) Avail: NTIS HC/MF A03

The irreducible Racah basis for SU(N + 1 N) is introduced. An analytic continuation with respect to N leads to infinite-dimensional superalgebras su(4u + 1 4u). Large 4u limit su(infinity + 1 infinity) is calculated. The higher spin Sugawara construction leading to generalizations of the Virasoro algebra with infinite tower of higher spin currents is proposed and related WZNW and Toda models as well as possible applications in string theory are discussed. DOE

N92-15673# International Centre for Theoretical Physics, Trieste (Italy).
APPROXIMATION NUMBERS AND TICHOMIROV NUMBERS OF AN INFINITE MATRIX OPERATOR ON THE SPACE I SUB 1
N. Faried (Ain Shams Univ., Cairo, Egypt) and Z. AbdEl-Kader Nov. 1990 8 p
(DE91-632259; IC-90/390) Avail: NTIS HC/MF A02

In this paper, we give upper and lower estimations of the approximation numbers and Tichomirov numbers of an infinite matrix T = (tau sub ij) sub i=1,(sup infinity) sub j=1 (sup infinity) on the space I sub 1. DOE

N92-15674# International Centre for Theoretical Physics, Trieste (Italy).
ESTIMATIONS OF S NUMBERS AND ENTROPY NUMBERS OF AN UNCOUNTABLY INFINITE MATRIX
N. Faried (Ain Shams Univ., Cairo, Egypt) and Z. AbdEl-Kader Nov. 1990 9 p
(DE91-632260; IC-90/391) Avail: NTIS HC/MF A02

In this paper, we give upper and lower estimations for some s-numbers of an infinite matrix T = (tau sub ij) sub IXJ from the spaces I sub infinity (J) and I sub 1 (J), into the spaces I sub infinity (I) and I sub 1 (I), (I and J are not necessarily countable and not necessarily ordered), of all bounded families and summable families respectively. DOE

N92-15675# International Centre for Theoretical Physics, Trieste (Italy).
NON-PERTURBATIVE SUPERSYMMETRY ANOMALY IN SUPERSYMMETRIC QCD
Y. Shamir Mar. 1991 39 p
(DE91-641526; IC-91/37) Avail: NTIS HC/MF A03

The zero modes of the Dirac operator in an instanton and other topologically non-trivial backgrounds are unstable in a large class of massless or partially massless supersymmetric gauge theories. We show that under a generic perturbation of the scalar fields all zero modes become resonances, and discuss the ensuing breakdown of conventional perturbation theory. As a result, despite of the presence of massless fermions, the field theoretic tunneling amplitude is not suppressed. In massless supersymmetric QCD with N(sub c) is less than or equal to N(sub f) the effective potential is found to be negative and monotonically increasing in the weak coupling regime for scalar VEVs which lie on the perturbatively flat directions. Consequently, massless supersymmetric QCD with N(sub c) less than or equal to N(sub f) exhibits a non-perturbative supersymmetry anomaly and exists in a strongly interacting phase which closely resembles ordinary QCD. The same conclusions apply if small masses are added to the lagrangian and the massless limit is smooth. DOE

N92-15676# Moscow State Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki.
A METHOD OF EVALUATING MASSIVE FEYNMAN INTEGRALS
E. E. Boos and A. I. Davydychev 1990 24 p
(DE91-640793; INP-MSU-90-11-157; NIIYaF-MGU-90-11-157)
Avail: NTIS HC/MF A03

A general method of evaluation of the massive Feynman integrals is presented. It is based on the representation of massive denominators in the form of Mellin-Barnes integrals. Expressions for some classes of one-loop propagator and vertex-type massive Feynman integrals are obtained at arbitrary values of line indices and the space-time dimension. The results are given in the form of hypergeometric functions. This makes it possible to examine various regions of momenta. DOE

N92-15677# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
SUM RULES, ASYMPTOTIC BEHAVIOUR AND (MULTI)BARYON STATES IN THE SKYRME MODEL
J. A. Mignaco and S. Wulck (Universidade Federal do Rio de Janeiro, Brazil) 1990 12 p
(DE91-641807; CBPF-NF-028/90) Avail: NTIS HC/MF A03

We obtain sum rules that should be satisfied by the solutions of the Euler-Lagrange equation for the chiral angle in the Skyrme model in the hedgehog representation. The sum rules allow one to determine the existence of solutions with integer baryon numbers for well determined values of a relevant dimensionless parameter Phi only. For all other values, there are no solutions with integer baryon numbers, in particular for the pure non-linear sigma model. DOE

N92-15678# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
ON TACHYON QUANTIZATION
C. G. Bollini and J. J. Giambiagi 1990 17 p
(DE91-641808; CBPF-NF-038/90) Avail: NTIS HC/MF A03

There are two different cases in (vector) K-space for tachyon quantization. We concentrate our discussion on the second case (absolute value of K squared is less than M squared), for which we write the Hamiltonian, which is different from the usual harmonic oscillator one, and solve the corresponding eigenvalue equation. The spectrum is continuous and we find the energy creation and destruction operators. DOE

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N92-15679# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
ALGEBRAIC THEORY OF STARK-ZEEMAN DYNAMIC EFFECT IN HYDROGEN-LIKE ATOM
D. V. Fursa and G. L. Yudin 1990 37 p In RUSSIAN; ENGLISH summary
(DE91-636261; FEI-2088) Avail: NTIS HC/MF A03

The problems of calculating the time evolution operator within the given n-shell (here n is a main quantum number) for the hydrogen atom located in non-stationary electric and magnetic fields is under investigation. Making use of the Fock SO(4) group reduces this problem to the set of problems with linear realization of the dynamic symmetry group for which the evolution operator is the operator of the corresponding groups representation. The types of evolution operator parametrization, in the form of exponent products (the Wei-Norman method) determined by using D-functions connected with Euler angles and Cayley-Klein parameters, are discussed. It is shown that the problem of evolution operator calculation can be reduced to an investigation of a pair of two-level systems. DOE

N92-15680# Drexel Univ., Philadelphia, PA. Dept. of Physics.
NON-ACCELERATOR PARTICLE PHYSICS
R. I. Steinberg and C. E. Lane Sep. 1991 49 p
(Contract DE-FG02-91ER-40615)
(DE92-001857; DOE/ER-40615/1) Avail: NTIS HC/MF A03

The goals of this research are the experimental testing of fundamental theories of physics such as grand unification and the exploration of cosmic phenomena through the techniques of particle physics. We are working on the MACRO experiment, which employs a large area underground detector, to search for grand unification magnetic monopoles and dark matter candidates and to study cosmic ray muons as well as low and high energy neutrinos. The NuIMB project seeks to: refurbish and upgrade the IMB water Cerenkov detector to perform an improved proton decay search together with a long baseline reactor neutrino oscillation experiment using a kiloton liquid scintillator (the Perry experiment); and to develop technology for improved liquid scintillators, very low background materials in support of the MACRO and Perry experiments, and for new solar neutrino experiments. DOE

N92-15681# National Science Foundation, Washington, DC.
ACADEMIC RESEARCH EQUIPMENT AND EQUIPMENT NEEDS IN THE PHYSICAL SCIENCES: 1989
Kenneth Burgdorf (Westat Research, Inc., Rockville, MD.) Jan. 1991 34 p Sponsored in part by NIH Its Survey of Science Resources Series
(Grant NSF SRS-88-21876)
(NSF-91-305) Avail: NTIS HC/MF A03

This monograph is one in a series of analytical reports presenting findings from the National Science Foundation's 1989-90 National Survey of Academic Research Instruments and Instrumentation Needs. It describes recent national trends in academic research equipment and equipment needs in the physical sciences. The data were obtained from a sample of 55 universities statistically selected to represent all institutions with science/engineering research and development expenditures of $3 million or more. The analysis compares data obtained in 1989 to similar data collected from the same institutions in 1986 and 1983. Information about current needs and priorities refers to the year the survey was conducted; information about equipment amounts and expenditures refers to the year prior to the year of the survey. The study is limited to research equipment originally costing $10,000 or more per system. It includes existing research equipment, funding sources, annual expenditures, equipment needs, and perceived trends. Author

N92-15682# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
SIMULATION OF CONFINED PRIMITIVE ELECTROLYTES: APPLICATION OF A NEW METHOD OF SUMMING THE COULOMB FIELD Technical Report No. 4, period ending 1 Jan. 1991
Lianrui Zhang, Henry S. White, and H. T. Davis 10 Nov. 1991 12 p
(Contract N00014-91-J-1927)
(AD-A242446) Avail: NTIS HC/MF A03 CSCL 20/3

Recently, Lekner has presented a new method to sum the Coulomb forces between charged particles of a central system and its images extended periodically in 2 and 3-dimensions. In this paper we apply the new method in canonical ensemble Monte Carlo (CMC) simulations of the primitive electrolyte confined between two planar surfaces: one is charged and the other is neutral. The anions and cations have identical size with diameter d = 4.25 Angstroms and interact with a hard sphere repulsion and Coulomb interaction. In Lekner's method the long-range Coulomb potential is computed from a series of Bessel functions. We have demonstrated that the series converges after about 10 terms and so is computationally simpler that the Ewald sum method. In our simulation, we obtained the density distributions and mean electrostatic potentials of the confined system for the 1:1 electrolyte having concentrations equal to those of 1M and 2M bulk electrolyte and having different surface charge densities. For large separation of confining walls, the canonical ensemble Monte Carlo results agree with previously reported grand canonical Monte Carlo results. GRA

N92-15683# Houston Univ., TX.
QUESTIONS ON CRITERIA USED FOR MAGNET FIELD QUALITY
S. Ohnuma 1991 4 p Presented at the 5th International Committee for Future Accelerators (ICFA) Beam Dynamics Workshop, Corpus Christi, TX, 3-8 Oct. 1991
(Contract DE-FG05-87ER-40374)
(DE92-002611; DOE/ER-40374/59; CONF-9110243-2) Avail: NTIS HC/MF A01

Questions are raised here, without providing any answers to them, regarding the standard way of specifying the tolerances on various multipole components in superconducting dipoles. They are: (1) dependence of systematic b(sub 6) (normal 14-pole) and b(sub 8) (normal 18-pole) on the required momentum aperture; (2) importance of resonance with (and its precise meaning) for specifying random low-order multipoles; and (3) understanding tracking results in terms of multipole components. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N92-15684# Naval Oceanographic and Atmospheric Research Lab., Bay Saint Louis, MS.
AN ASSESSMENT OF NEAR SURFACE BIOLOGICAL VOLUME SCATTERING OFF THE CONTINENTAL SHELF OF VIRGINIA Final Report
R. W. Nero and R. H. Love Jul. 1991 43 p
(Proj. 032-04)
(AD-A240991; AD-E040122; NOARL-TN-144) Avail: NTIS HC/MF A03 CSCL 20/1

Acoustic models were used to estimate volume scattering from fish and marine mammals in the vicinity of the Surface WAves Dynamics Experiments (SWADE) at 37.5 N and 74 W as part of planning for the Office of Naval Research Acoustic Reverberation Special Research Project (ARSRP) sea surface scattering experiment. Animal densities were derived from fisheries assessments and airborne surveys of marine mammals, Animal target strengths were based on resonant models of fish with swimbladders, bent cylinder models of fish without swimbladders, and in situ measurements of mammals. Estimates of scattering

were made for a broad frequency range of 10 Hz to 10 kHz with emphasis placed on the planned experimental frequencies of 100 Hz to 800 Hz. Average layer scattering strengths calculated for average densities of animals at two potential experimental sites ranged from -74 to -53 dB between 100 and 800 Hz. Since most fish and marine mammals will be aggregated to some degree, volume scattering can be expected to vary within the area insonified during ARSRP measurements. A model of fish school encounter suggests that only aggregations of porpoise, mesopelagic fish and nonswimbladder bearing fish are widespread enough to produce consistent reverberation, producing layer strengths slightly above -80 dB. Given the variations with frequency, location, time of day, and uncertainties of animal distribution, layer strengths at the experimental sites are expected to be between -80 and -50 dB. The GRA

N92-15685# Academy of Sciences (USSR), Novosibirsk. Inst. Yadernoj Fiziki.
LARGE AMPLITUDE ION-ACOUSTIC WAVES. STOCHASTIC PHENOMENA, 1
N. S. Buchelnikova and E. P. Matochkin 1990 70 p In RUSSIAN; ENGLISH summary
(DE91-636671; IYaF-90-7) Avail: NTIS HC/MF A04

Numerical experiments (OUC-method) were carried out to study the stochastic instability of the electron motion in the course of the evolution of one-dimensional nonlinear ion-acoustic waves. The initial parameters of the ion-acoustic waves correspond to the cases of the linear, nonlinear, strongly nonlinear with ion trapping, and breaking waves. It is shown that the evolution of the nonlinear ion-acoustic wave is accompanied by the development of the stochastic instability of the electron motion. The growth rate of the instability increases with increasing nonlinearity of the wave. The evolution of the stochastic instability and the formation of the stochastic layer is studied. It is shown that the stochastic layer includes all the initial trapping region of the electrons in the ion-acoustic wave and a part of the phase space outside of it. DOE

N92-15686*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ASSESSMENT OF PROBABILITY OF DETECTION OF DELAMINATIONS IN FIBER-REINFORCED COMPOSITES
E. J. Chern, H. P. Chu, and J. N. Yang (California Univ., Irvine.) Washington Dec. 1991 20 p
(NASA-TM-104553; NAS 1.15:104553; Rept-92B00022) Avail: NTIS HC/MF A03 CSCL 20A

Delamination is one of the critical defects in composite materials and structures. An ultrasonic C-scan imaging technique which maps out the acoustic impedance mismatched areas with respect to the sample coordinates, is particularly well suited for detecting and characterizing delaminations in composites. To properly interpret the results, it is necessary to correlate the indications with the detection limits and probability of detection (POD) of the ultrasonic C-scan imaging technique. The baseline information on the assessment of POD of delaminations in composite materials and structures is very beneficial to the evaluation of spacecraft materials. In this study, we review the principle of POD, describe the laboratory set-up and procedure, and present the experimental results as well as assessment of POD of delaminations in fiber reinforced composite panels using ultrasonic C-scan techniques. Author

N92-15687# Naval Postgraduate School, Monterey, CA.
A CHARACTERIZATION OF UNDERWATER SOUND PRODUCED BY HEAVY PRECIPITATION M.S. Thesis
Chih-Lung Tan Dec. 1990 70 p
(AD-A242429) Avail: NTIS HC/MF A04 CSCL 20/1

An experiment by the Naval Postgraduate School and the National Data Buoy Center was performed in the Gulf of Mexico to investigate the underwater sound generated by heavy precipitation under a variety of conditions. During the first stage of the experiment, nine data sets were obtained with rainfall rates up to 300 mm/hr. The characteristic fifteen kilohertz peak in the underwater sound spectrum generated by small raindrops in light rain is absent during heavy rain. These data sets show a good correlation between rainfall rate and underwater sound levels, suggesting that acoustic measurement of rainfall rate at sea is possible. The correlation is best at lower frequencies (2 to 10 kHz). At higher frequencies (12 to 22 kHz) low spectral levels are observed in conditions of high wind (greater than 10 m/s), presumably due to sound absorption by ambient bubble clouds from breaking waves. At very high rainfall rates (greater than 200 mm/hr), low levels at higher frequencies are also observed suggesting that the rain itself is capable of producing large populations of bubbles which absorb the sound radiated from the surface. GRA

N92-15688# Naval Postgraduate School, Monterey, CA.
POLE-ZERO MODELING OF TRANSIENT WAVEFORMS: A COMPARISON OF METHODS WITH APPLICATION TO ACOUSTIC SIGNALS M.S. Thesis
Gary L. May Mar. 1991 106 p
(AD-A242657) Avail: NTIS HC/MF A06 CSCL 20/1

The modeling of damped signals as the impulse response of a pole-zero system is considered for a broad range of pole zero modeling algorithms. The goal is to obtain the best possible fit between the model impulse response and the modeled signal. Prony's method, the least squares modified Yule-Walker equations (LSMYWE), iterative prefiltering, and the Akakie maximum likelihood estimator are compared on known test sequences for a variety of model degrading situation (e.g., additive noise) to develop an understanding of which methods are most suitable for modeling real world signals. A correlation domain version of interative prefiltering is also introduced. The most robust algorithms are determined to be LSMYWE using singular value decomposition and iterative prefiltering (including the correlation domain version). Modeling several laboratory generated short duration acoustic signals confirmed the robustness of LSMYWE and iterative prefiltering. It is shown that correlation domain iterative prefiltering outperforms standard iterative prefiltering when large model orders are required for accurate modeling. Shank's method was determined to be the most effective method of determining the zeros of a pole-zero model when a time domain match is required. GRA

N92-15689# Naval Postgraduate School, Monterey, CA.
ARRIVAL TIME TRACKING OF PARTIALLY RESOLVED ACOUSTIC RAYS WITH APPLICATION TO OCEAN ACOUSTIC TOMOGRAPHY M.S. Thesis
Edwin K. Chaulk Mar. 1991 157 p
(AD-A242715) Avail: NTIS HC/MF A08 CSCL 20/1

Accurate estimation of arrival times along an ocean acoustic ray path is an important component of ocean acoustic tomography. A straightforward method of arrival time estimation, based on locating the maximum value of an interpolated arrival, was used with limited success for analysis of data from the December 1988 Monterey Bay Tomography Experiment. Close examination of the data revealed multiple closely spaced arrivals of similar amplitude, only partially resolved in many returns. A modification to the original tracking algorithm succeeded in improving the estimates and lead to the development of a tracker based on a least mean squares (LMS) linear predictive filter. A second algorithm, based on a modified recursive least squares (MRLS) solution, allows the estimation of dynamic spectral processes at surface and internal wave frequencies in the tomography arrivals. GRA

N92-15013# Naples Univ. (Italy).
LINEAR ACOUSTICS IN GAS MIXTURES WITH RATE PROCESSES
Luigi G. Napolitano *In* ESA, Aerothermodynamics for Space Vehicles Jul. 1991 p 317-324 (For primary document see N92-14973 06-02)
Copyright Avail: NTIS HC/MF A24; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 Dutch guilders

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N92-15690# International Centre for Theoretical Physics, Trieste (Italy).
THE Mo/Ta (100) INTERFACE
C. Quintanar (Universidad Nacional Autonoma de Mexico, Mexico City.), R. Baquero, V. R. Velasco, and F. Garcia-Moliner Dec. 1990 8 p
(DE91-634186; IC-90/433) Avail: NTIS HC/MF A02

We have calculated the Interface Local Density Of States (ILDOS) formed by the transition metals Mo/Ta using a tight-binding Slater-Koster description and the Green Function matching method together with quickly converging algorithms to compute the transfer matrices. We obtain the surface LDOS as a byproduct. Our result is a useful tool to analyze experimental results and to check models as a function of the value of the tight-binding parameters either of the bulk or at the interface itself. We consider the (100) direction. We compare the interface to the bulk and to the surface and comment on some recently found experimental results for this interface. DOE

N92-15691# Academy of Sciences (USSR), Leningrad. Inst. Yadernoj Fiziki.
ION SOURCE OF A MASS-SEPARATOR WITH ACCUMULATION AND BUNCHING OF IONS
G. D. Alkhazov, K. V. Lukashin, V. N. Panteleev, and V. I. Romanov 1990 18 p In RUSSIAN; ENGLISH summary
(DE91-636294; LIYaF-1586) Avail: NTIS HC/MF A03

A new method providing accumulation (bunching) of ions emerging from a surface ion source has been worked out and tested on the mass separator of the IRIS facility. It is shown that in a rather wide range of time parameters of bunching (T(sub accumulation) = 10(exp -4) - 10(exp -1)s, tau(sub bunching) = 10(exp -6) - 10(exp -3)s) the average ion current of the ion source differs insignificantly from that in the continuous mode, the pulsed current of ions being dozens of times larger. The measurements were carried out for high temperature ion sources fabricated from refractory metals niobium and tungsten. DOE

N92-15692# Academy of Sciences (USSR), Leningrad. Inst. Yadernoj Fiziki.
HEAVY MESONS IN THE BOOTSTRAP QUARK MODEL
S. M. Gerasyuta and A. V. Sarantsev 1990 20 p In RUSSIAN; ENGLISH summary
(DE91-637130; LIYaF-1601) Avail: NTIS HC/MF A03

In the frame of an approach developed for light quarks, the scattering amplitudes of heavy quarks qQ-bar to qQ-bar, QQ-bar to QQ-bar (q = u,d,s; Q = c,b,t) are calculated. The obtained mass values of the lowest c,b-mesons multiplets (J(sup P) = 0(-), 1(-), 0(+)) are in good agreement with the experimental ones. The masses of the new heavy particles with the t-quark are predicted. DOE

N92-15693# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
ON THE SIMULATION OF GAMMA QUANTUM COMPTON SCATTERING
V. N. Aleshechkin 1990 11 p In RUSSIAN; ENGLISH summary
(DE91-637277; FEI-2096) Avail: NTIS HC/MF A03

An efficient precise algorithm of modeling differential Compton scattering cross sections of gamma-quanta on free electrons (the Klein-Nishina-Tamm law), based on the Neiman method is presented. The algorithm efficiency (the time of scattering modeling) decreases only 1.3 times when the energy of incident photon changes from 1 to 1000000 MeV. The code of scattering modeling in FORTRAN-77 for the PC/AT computer is given. DOE

N92-15694# Oak Ridge National Lab., TN.
PROGRESS IN COLLISIONS OF MULTIPLY CHARGED IONS
R. A. Phaneuf 1991 12 p Presented at the 8th Topical Conference on Atomic Processes in Plasmas, Portland, ME, 25-29 Aug. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000735; CONF-9108105-1) Avail: NTIS HC/MF A03

The increasing power and availability of supercomputers during the last decade led to significant progress in the theory of multicharged ion interactions. However, important tests of many theoretical predictions were lacking, and have become possible only quite recently as new capabilities have been realized in the laboratory. This paper broadly surveys some of these experimental developments, and their impact on our understanding of collisional interactions of multicharged ions. The scope is limited to measurements made with monoenergetic beams. DOE

N92-15695# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
CONDUCTOMETRIC INVESTIGATIONS OF MULTICHARGED ION TRACK STRUCTURE IN VARIOUS POLYMERS
P. Yu. Apel 1989 10 p In RUSSIAN; ENGLISH summary
(DE91-628389; JINR-R-16-89-401) Avail: NTIS HC/MF A02

The radial structure of etchable tracks of multicharged ions in polyethylene terephtalate, polycarbonate, polyarylate, and polypropylene is investigated using conductometric method. The doses of gel formation under irradiation of these polymers by accelerated xenon ions with approximately 1 MeV/nucleon energy are estimated. It is found that the track of highly ionizing particles in a polymer consists of a core where intensive destruction occurs and a halo where, as a rule, the crosslinking of macromolecules predominates. Recombination of the interior radicals provides the crosslinking formation. The radius of the crosslinking region depends on the relation between the hydrogen atom diffusion speed and the rate of their chemical interaction with macromolecules. DOE

N92-15696# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NEUTRON COMPONENTS OF ISOSCALAR GIANT QUADRUPOLE RESONANCE STATES IN (58, 60, 62, 64)Ni
R. Antalik 1989 8 p
(DE91-628748; JINR-E-4-89-804) Avail: NTIS HC/MF A02

The neutron-proton matrix element ratios (eta) for isoscalar giant quadrupole resonance states of even Ni isotopes are investigated within the framework of the shell model quasiparticle random-phase approximation. The dependence of eta ratios on radial neutron and proton ground state density distribution differences (delta(exp np)) is found to be about 1.0-1.5 delta(exp np). The theoretical eta ratios are 14-23 percent lower than the hydrodynamical limit. The agreement between theoretical and experimental eta ratios is observed for Ni-58 and Ni-60 isotopes. The eta ratios for Ni-62 and Ni-64 suggested by the resonance pi(sup +-) inelastic scattering cannot be interpreted even including the radial variations of the neutron fields. DOE

N92-15697# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
MULTIPLICITY OF CHARGED PARTICLES IN INTERACTIONS OF OXYGEN NUCLEI WITH HYDROGEN AT 3.1XA GeV/c
V. V. Glagolev, R. M. Lebedev, and G. D. Pestova (Joint Inst. for Nuclear Research, Dubna, USSR) 1989 7 p In RUSSIAN; ENGLISH summary
(DE91-628834; JINR-R-1-89-218) Avail: NTIS HC/MF A02

The experiment has been performed on the 100 cm hydrogen bubble chamber. The O-16(+p) interactions have been investigated at 3.1A GeV/c incident momentum. The productions of charged pions can be explained in the frame of multiple nucleon-nucleon interaction. There is no contradiction with the assumption of several independent interactions of the target proton inside the oxygen nucleus. DOE

N92-15698# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
KINETICS OF THE EXCITED MUONIC HYDROGEN IN THE MIXTURES OF HYDROGEN ISOTOPES IN HELIUM

V. M. Bystritskij (Joint Inst. for Nuclear Research, Dubna, USSR), A. V. Kravtsov, and N. P. Popov 1989 11 p In RUSSIAN; ENGLISH summary
(DE91-634152; JINR-R-4-89-561) Avail: NTIS HC/MF A03

De-excitation of the excited muonic hydrogen in the mixtures of hydrogen isotopes and helium is considered. The method is proposed which allows one to determine the rates of the muon transfer from the excited muonic hydrogen to helium nuclei, as well as the probability of the direct muon atomic capture by nuclei of hydrogen isotopes. DOE

N92-15699# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
ON THE DURATION OF NUCLEAR REACTIONS
V. N. Streltsov 1989 4 p In RUSSIAN; ENGLISH summary
(DE91-634660; JINR-R-2-89-366) Avail: NTIS HC/MF A01

The duration of nuclear reactions is noted to increase with the increasing energy of particles. The fact that the field before a relativistic particle affects ever increasing distances with increase in its velocity, forms the basis for this effect. The indicated field is concentrated in a narrow cone (direction forward) at an apex angle (theta) proportional to gamma(exp -1) where gamma is the Lorentz-factor. An opinion is expressed that the latter fact underlies the known phenomenon of the decrease in the emission angles of secondary particles in multiple production processes with increasing energy. DOE

N92-15700# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CALCULATION OF THE HIGGS BOSON DECAY WIDTH INTO FERMION PAIRS
D. Yu. Bardin, P. Ch. Christova (Joint Inst. for Nuclear Research, Dubna, USSR), and B. M. Vilenskij 1990 18 p In RUSSIAN; ENGLISH summary
(DE91-637011; JINR-R-2-90-287) Avail: NTIS HC/MF A03

The Higgs boson decay width into any fermion pair is calculated taking into account the one-loop electroweak and quantum-chromodynamic corrections. The exact expressions for all corrections are presented and their dependence on chi-boson and t-quark masses is analyzed. Some specific peculiarities, which are connected with the occurrence of mass singularities in the quantum-electrodynamical part of the correction are discussed. It is demonstrated that in the limit M(sub chi) much greater than M(sub W), the expression for the electroweak correction contains a quadratically enhanced term, which was found earlier by Veltman. The obtained results are shown graphically. DOE

N92-15701# Nauchno-Issledovatelskii Inst. Ehlekt- Rofizicheskoj Apparatury, Leningrad (USSR).
COMPARISON OF THE EFFICIENCY OF PERSPECTIVE METHODS FOR CALCULATION OF ELECTRIC POTENTIAL IN REGIONS WITH COMPLEX CONFIGURATION OF BOUNDARIES [SRAVNENIE EHFFEKTIVNOSTI PERSPEKTIVNYKH METODOV RASCHETA POTENTSIALA V OBLASTYAKH SO SLOZHNOJ KONFIGURATSIEJ GRANITS]
M. G. Baranova, E. N. Vyuga, and A. S. Tikhomirov 1989 7 p In RUSSIAN
(DE91-624835; NIIEFA-P-V-0810) Avail: NTIS HC/MF A02

The problem of determining the charged particle beam parameters at the inlet to an accelerating system occurs in the process of developing linear electron and ion accelerators. The first step in solving this problem consists in the calculation of electrostatic field in electron-optical systems. Program complexes for solving the finite-difference analog of the Laplace equation are developed. A comparative analysis of the efficiency of applying the variable-triangle method with minimal closing errors and the method of line run with the upper relaxation to solve this problem is considered. Identical results within the limits of the scheme accuracy, as well as coincidence by calculation time and the required operative memory, are obtained in the test problems. DOE

N92-15702# Academy of Sciences (USSR), Novosibirsk. Inst. Yadernoj Fiziki.
THEORY OF DIFFUSION PHOTOEFFECT IN HYDROGEN ATOM, PART 4.5 [TEORIYA DIFFUZIONNOGO FOTOEHFFEKTA V ATOME VODORODA. CHAST 4.5]
D. L. Shepelyanskij 1989 68 p In RUSSIAN
(DE91-625196; IYaF-89-93) Avail: NTIS HC/MF A04

Excitation of hydrogen atoms in linearly and elliptical polarized fields is considered. It is shown that excitation localization in a two-dimensional hydrogen atom model is the same as in the one-dimensional case. In this case strong excitation inside the shell does not affect energy localization due to Coulomb degeneration. The conclusion is made that the effect of quantum localization of dynamic chaos can be observed in a laboratory experiment. DOE

N92-15703# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
H(0) TO TAU(+) TAU(-) DETECTION AT THE LHC
K. Bos, F. Anselmo, and B. vanEijk (European Organization for Nuclear Research, Geneva, Switzerland) 1991 12 p Sponsored by Netherlands Organization for Applied Scientific Research TNO
(NIKHEF-H/91-01; ETN-92-90444) Avail: NTIS HC/MF A03

A study on the LHC (Large Hadron Collider) production of the standard model Higgs, subsequently decaying into tau leptons, is presented. The so called intermediate Higgs mass range of 100 to 160 GeV/c squared is focused on. It is assumed that LEP (European electron-positron collider) will provide a mass limit up to roughly the W(+,-) mass, and will recognize that experimental signals from the decay of a Higgs with a mass close to the Z(0) mass will be impossible or otherwise extremely difficult to disentangle from the dominating Z(0) decay signal. Clear decay signatures, e.g., multi lepton decay channels, become only important close to, or above the W(+)W(-) pair threshold. Hadronic decay modes will be overwhelmed by a large background of ordinary QCD (quantum chromodynamic) jets. The only, relatively sizeable, decay modes with extraordinary experimental signatures that are left are the gamma gamma decay channel and tau pairs, where it is required that each tau decays semileptonically into a single charged lepton plus two neutrinos. Implications on the cross sections and branching ratios for different values for the top quark mass and the Higgs mass are presented. The conclusion is that the overwhelming background due to heavy flavor production through either pure QCD processes and/or other heavy flavor sources makes it difficult, though maybe not impossible to observe the signal. ESA

N92-15704# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
GLUON-GLUON FUSION AT HERA
K. J. Abraham 1991 10 p Submitted for publication
(NIKHEF-H/91-02; ETN-92-90445) Avail: NTIS HC/MF A02

Predictions of perturbative quantum chromodynamics (QCD) are verified experimentally. Corrections to the electroproduction cross section of J/psi at HERA collider energies are calculated. It is shown that these energies arise from gluons in the photon interacting with gluons in the proton. They may be isolated by suitable phase space cuts. Implications for the extraction of the gluon density of the proton at HERA are discussed. ESA

N92-15705# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
NEW PERSPECTIVES ON THE ELECTRO-WEAK INTERACTIONS
F. R. Klinkhamer 1991 8 p Submitted for publication Sponsored by the Royal Netherlands Academy of Arts and Sciences
(NIKHEF-H/91-10; ETN-92-90452) Avail: NTIS HC/MF A02

Classical aspects of the electroweak standard model, and possible implications for cosmology and future particle colliders are discussed. It is shown that configuration space has nontrivial structure, that this structure is characterized by the sphaleron, S,

and that it may lead to significant nonperturbative effects, such as the violation of baryon number conservation. ESA

N92-15706# Rutherford Appleton Lab., Chilton (England).
FINDING JETS AND SUMMING SOFT GLUONS: A NEW ALGORITHM
Nick Brown and W. J. Stirling (Durham Univ., England) Jul. 1991 24 p
(RAL-91-049; DTP/91/30; ETN-92-90707) Avail: NTIS HC/MF A03

A new algorithm for finding jets in electron-positron annihilation, using a jet measure based on relative transverse momentum, is examined. An analytic calculation of the three jet fraction at lowest order is performed. The result is compared with the standard jet finding algorithm. For soft gluons in an abelian theory, it is shown that the leading double algorithms exponentiate, unlike the situation for the commonly used algorithm based on invariant mass. In quantum chromodynamics, it is found that there are leading non-abelian logarithms, which are calculated explicitly at O (alpha sub m exp 2). The modifications to the algorithm which are needed when the mass of a parton cluster is taken into account are discussed. The hope is that the new algorithm will allow an improved theoretical analysis at smaller values of the resolution parameter y sub T, and an improved fit to the experimental data. ESA

N92-15707# Rutherford Appleton Lab., Chilton (England).
THE MASS-HIERARCHY PUZZLE AND THE 17-keV NEUTRINO IN THE CONTEXT OF A UNIVERSAL SEESAW MODEL
Elena Papageorgiou and Stefano Ranfone Jun. 1991 26 p
(RAL-91-051; ETN-92-90708) Avail: NTIS HC/MF A03

In the light of renewed evidence for the existence of a 17 keV neutrino, the possible mass patterns for the charged and the neutral leptons are studied. The investigation is performed in the context of a generalized seesaw type of model, which implements a horizontal U(1)(sub A) Peccei-Quinn symmetry. Under some general assumptions concerning the structure of the mass matrix, it is found that the mass hierarchy between the first two generations of charged leptons and the third one is explained in terms of the natural scales of the model. An additional assumption is made; namely, that the Majorana and Dirac type coupling constants, generally assumed to be independent to each other, are proportional. In this model, the spectrum contains an intermediate mass Dirac tau neutrino and two very light Majorana states, which are essentially the electron and the muon neutrinos. Identifying the 17 keV neutrino with the Dirac state, and using the bounds on the Peccei-Quinn scale, it is found that the mass of the two light states turns out to be in the right range, required by the Mikheyev-Smirnov-Wolfenstein solution of the solar neutrino problem. A cosmologically consistent lifetime for the Simpson neutrino is obtained through its decay into an axion and the electron neutrino. ESA

N92-15708# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
STATISTICAL TRANSFORMATION MODELS FOR THE GENERAL PROBLEM OF THREE BODIES
Adolf A. Agbormbai Feb. 1990 49 p
(IC-Aero-90-02; ISSN-0308-7247; ETN-92-90709) Avail: NTIS HC/MF A03

The techniques for formulating statistical transformation models of many body interactions with excited internal states are illustrated by considering the three body problem. In this regard a reciprocity equation is adopted as the starting point of the construction procedure. The formulated models are classified according to the ease with which energy can be interchanged among the various modes, and to the level of sophistication of the energy exchange process. The models are formulated via two general techniques: the methodical or systematic method and the short cut approach. The systematic method is long and serves to illustrate the detailed physics of the exchange process. The short cut method is short, involving only half the number of steps of the methodical approach. An H theorem is formulated for the many body interactions in bulk and at the gas solid boundary. Equilibrium distributions for these interactions are also constructed. ESA

N92-15709# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
RECIPROCITY THEORY OF HOMOGENEOUS REACTIONS
Adolf A. Agbormbai Mar. 1990 54 p
(IC-Aero-90-03; ISSN-0308-7247; ETN-92-90710) Avail: NTIS HC/MF A04

The reciprocity formalism is applied to the homogeneous gaseous reactions in which the structure of the participating molecules changes upon collision with one another, resulting in a change in the composition of the gas. The approach is applied to various classes of dissociation, recombination, rearrangement, ionizing, and photochemical reactions. It is shown that for the principle of reciprocity to be satisfied it is necessary that all chemical reactions exist in complementary pairs which consist of the forward and backward reactions. The backward reaction may be described by either the reverse or inverse process. The forward and backward processes must satisfy the same reciprocity equation. Because the number of dynamical variables is usually unbalanced on both sides of a chemical equation, it is necessary that this balance be established by including as many of the dynamical variables as needed before the reciprocity equation can be formulated. Statistical transformation models of the reactions are formulated. The models are classified under the titles free exchange, restricted exchange and simplified restricted exchange. The special equations for the forward and backward processes are obtained. The models are consistent with the H theorem and Le Chatelier's principle. The models are also formulated in the context of the direct simulation Monte Carlo method. ESA

N92-15710# Japan Atomic Energy Research Inst., Ibaraki.
MEASUREMENT OF FORMATION CROSS SECTIONS OF SHORT-LIVED NUCLEI BY 14 MeV NEUTRONS: Mg, Si, S, Cl, Cr, Zn, Ga, Y, In
Kiyoshi Kawade, Hiroshi Yamamoto, Takashi Yamada, Toshio Katoh, Toshiyuki Iida, and Akito Takahashi (Osaka Univ., Japan) Oct. 1990 76 p
(DE91-003000; JAERI-M-90-171; NEANDC(J)-154/U; INDC(JPN)-140/L) Avail: NTIS HC/MF A05

Sixteen neutron activation cross sections for (n,2n), (n,p), (n,n(prime)p), (n,t) and (n, alpha) reactions producing short-lived nuclei with half-lives between 0.5 and 20 m have been measured in the energy range of 13.4 to 14.9 MeV for Mg, Si, S, Cl, Cr, Zn, Ga, Y and In. Five half-lives of short-lived nuclei produced by 14 MeV or thermal neutron bombardments were measured with Ge detectors for Cu-66, Zr-89m, Mo-91m, Nb-97m, and Rh-104m in the spectrum multi-scaling mode. DOE

N92-15711# International Centre for Theoretical Physics, Trieste (Italy).
ELECTRON POLARIZATION IN A QUANTUM WELL WITH UNIFORM ELECTRIC FIELD
K. F. Ilaiwi and M. Tomak Oct. 1990 16 p
(DE91-625260; IC-90/293) Avail: NTIS HC/MF A03

The polarization of a quantum electron confined in a one dimensional potential well in the presence of a uniform electric field is calculated numerically. It is shown that the negative polarization reported in the literature for weak fields for all excited subband states is an artifact of using infinite-barrier model. Our numerical work gives results in agreement with previous calculations for the infinite-barrier potential but it yields positive polarization for all values of the applied field for finite-barrier case. DOE

N92-15712# Sao Paulo Univ. (Brazil). Inst. de Fisica.
UNITARY POLE APPROXIMATION FOR THE COULOMB-PLUS-YAMAGUCHI POTENTIAL AND APPLICATION TO A THREE-BODY BOUND STATE CALCULATION

K. Ueta and G. W. Bund (Instituto de Fisica Teorica, Sao Paulo, Brazil) Dec. 1990 13 p
(DE91-641836; IFUSP-P-882) Avail: NTIS HC/MF A03

The Unitary Pole Approximation (UPA) is used to construct a separable representation for a potential U which consists of a Coulomb repulsion plus an attractive potential of the Yamaguchi type. The exact bound-state wave function is employed. Um is chosen as the potential which binds the proton in the 1d sub(5/2) single-particle orbit in F-17. Using the separable representation derived for U, and assuming a separable Yamaguchi potential to describe the 1d sub(5/2) neutron in O-17, the energies and wave functions of the ground state, 1(+), and the lowest, o(+), state of F-18 are calculated in the core-plus-nucleons model solving the Faddeev equations. DOE

N92-15713# International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee.
INTERMEDIATE ENERGY NUCLEAR DATA FOR APPLICATIONS
N. P. Kocherov, ed. Feb. 1991 200 p Presented at the Advisory Group Meeting on Intermediate Energy Nuclear Data for Applications, Vienna (Austria), 9-12 Oct. 1990
(DE91-641904; INDC(NDS)-245/L; CONF-9010411) Avail: NTIS HC/MF A09

A comprehensive review of the data needs for various applications was performed by the participants of the meeting. The status of compilation and evaluation of the needed data in the intermediate energy range of incident particles was discussed. The following broad application areas were identified and considered by the participants: intermediate energy nuclear data needed for accelerators; intermediate energy nuclear data needed for space applications; and intermediate energy nuclear data for medical applications. The role of nuclear model calculations in data evaluations in this energy range was considered. The possibilities of existing model codes were considered from the point of view of reliability, accuracy, cost of computer time, and availability to specialists in the Member States. The Meeting presentations were divided into the following three sessions: nuclear data needs in the intermediate energy range (6 papers), progress of nuclear data computations and evaluations in the intermediate energy range (6 papers), and progress of experimental data measurements in the intermediate energy range. A separate abstract was prepared for each paper. The ways of further improvement of the status of nuclear data in the intermediate energy range were discussed and the results of these discussions can be found in the conclusions and recommendations of this meeting. DOE

N92-15714# Brookhaven National Lab., Upton, NY.
A HIGH REPETITION RATE BEAM PROFILE MONITOR
J. T. Rogers, J. B. Warren, and A. Gray (State Univ. of New York, Stony Brook.) 1991 4 p Presented at the Workshop on Advanced Beam Instrumentation, Tsukuba (Japan), 20-28 Apr. 1991
(Contract DE-AC02-76CH-00016)
(DE92-002068; BNL-46695; CONF-9104225-3) Avail: NTIS HC/MF A01

A high repetition rate beam profile monitor is needed to measure the momentum distribution of each bunch in a 200 bunch train at the Brookhaven Accelerator Test Facility. We have designed a monitor using secondary emission from a microstrip delay line. The delay line converts position information into discrete time delays synchronous with the sampling rate of a fast transient digitizer. The results of initial electrical testing are presented. DOE

N92-15715*# West Virginia State Coll., Charleston.
CLASSICAL ELECTRON MASS AND FIELDS 2
Craig Spaniol and John F. Sutton (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.) 12 Jul. 1991 34 p
(Grant NAG5-1267)
(NASA-CR-189250; NAS 1.26:189250) Avail: NTIS HC/MF A03 CSCL 20H

Continued here is the development of a model of the electron (HYDRA), which includes rotational and magnetic terms. The atomic electron state is discussed and a comparison is made with a simple harmonic oscillator. Experimental data is reviewed that supports the possibility of a new lepton. Author

N92-15716# Japan Atomic Energy Research Inst., Tokyo.
NEW KINETIC THEORY FOR NON-EQUILIBRIUM DENSE GASES
Yukichi Taji (Japan Atomic Energy Research Inst., Tokai.) Mar. 1991 70 p
(DE91-508204; JAERI-M-91-031) Avail: NTIS HC/MF A04

In the usual kinetic theory of gases it has been believed that any states of gases are describable if the Liouville equation is suitably approximated because the equation describes every mechanical state of gases. Here, however, the Liouville equation, which is certainly deterministic in phase space, is clarified to be able to treat only isotropic equilibrium dilute gases in mu-space, through the discussion of which a new kinetic theory is proposed to treat anisotropic nonequilibrium dense gases. These matters are reported in Part 1. In Part 2, an extended Boltzmann equation is derived by applying the theory to the case of nonequilibrium monoatomic molecular dense gases in which the effect of triple collisions is considered so anisotropic momentum transfer in collisions can be treated. In Part 3, the case of nonequilibrium gases of dumbbell-shaped molecules is treated and moment equations of angular momentum transfer between rotating molecules are shown to be expressed in the same form as Maxwell's equations; this corresponds to the growth theory of thunder. DOE

N92-15717# Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study.
METASTABLE EXOTIC ATOMS OF EXTREME QUANTUM NUMBERS
Toshimitsu Yamazaki Apr. 1991 18 p
(DE91-508223; INS-868) Avail: NTIS HC/MF A03

New aspects of exotic atoms and nuclei which exhibit metastability (narrow width) are discussed. They are characterized by halo structure that protects the exotic particle from being absorbed promptly. Two examples are described: (1) deeply bound pionic atoms; and (2) metastable exotic helium atoms. DOE

N92-15718# Australian National Univ., Canberra. Research School of Physical Sciences.
CONTRASTING BEHAVIOUR OF PROTON h(9/2) AND h(11/2) BANDS IN Ir-(175,177,179,181) INTERPRETED IN AN INTRUDER MODEL
G. D. Dracoulis, B. Fabricius, and A. P. Byrne Jan. 1991 16 p
(DE91-632682; ANU-P-1073) Avail: NTIS HC/MF A03

Rotational bands in the odd proton isotope Ir-175, Ir-177, Ir-179, and Ir-181 based on the h(sub 9/2), h(sub 11)/(sub 2), i(sub 13/2) and d(sub 5/2) orbitals have been identified, the first three to high spin. In all cases the h(sub 9/2) band shows backbending with a crossing frequency and alignment gain consistent with that expected from the neutron i(sub 13/2)(exp 2) alignment. In contrast the h(sub 11/2) bands (and the fragments of d(sub 5/2) bands observed) show complex alignment curves. These alignments can be explained using a phenomenological three-band model which incorporates a deformed intruder band, analogous to that proposed in the very light Pt and Os nuclei. DOE

N92-15719# Sao Paulo Univ. (Brazil). Inst. de Fisica.
CONSERVATION LAWS FOR FERMIONS IN SPACES WITH TORSION
H. Fleming and E. O. Resek 1990 18 p
(DE91-639748; IFUSP-P-862) Avail: NTIS HC/MF A03

In General Relativity there is a conservation law, expressed in terms of the (symmetric) energy-momentum tensor, associated to each isometry of the space-time. Using Noether's theorem, we prove the validity of these conservation laws in the more

complicated case of Einstein-Cartan theory with spinorial matter. The proof is much harder because the energy-momentum tensor is not symmetric. DOE

N92-15720# Sao Paulo Univ. (Brazil). Inst. de Fisica.
SEMI-INCLUSIVE RAPIDITY DISTRIBUTIONS AND A CRITICAL ANALYSIS OF THE CONCEPT OF PARTITION TEMPERATURE
Y. Hama and M. Pluemer (Marburg Univ., Germany, F.R.) 1990 21 p
(DE91-639934; IFUSP-P-861) Avail: NTIS HC/MF A03

An analytical computation of the partition temperature of a n-particles system of total invariant mass M with a transverse-momentum cutoff has been performed. The result has been used to compare with the previously obtained fitted values at sq. root of s = 540 GeV, which show a complete disagreement with the now available ones, calculated by starting from the definition. The effect of the center-of-mass motion of the system on the pseudo-rapidity distributions is also discussed. DOE

N92-15721# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
HIGH MOMENTUM TRANSFER HADRON PAIR PRODUCTION IN PROTON-NUCLEAR COLLISIONS AT 70 GeV
V. V. Abramov, B. Yu. Baldin, and A. F. Buzulutskov 1990 3 p Submitted for publication
(DE91-639962; IHEP-OEF-90-103; IFVE-OEF-90-103) Avail: NTIS HC/MF A01

The cross sections for hadron pair production by protons off D, Be, Cu, and Pb nuclei have been measured at 70 GeV. The A-dependence of the cross section is not described by the exponential A(sup alpha). For heavy nuclei, alpha(sub pi pi) is falling down with the increase of P(sub t). DOE

N92-15722# Sao Paulo Univ. (Brazil). Inst. de Fisica.
EXPLORATORY STUDIES OF THE ELASTIC SCATTERING OF Li-11+C-12
G. R. Satchler, K. W. Mcvoy (Wisconsin Univ., Madison.), and M. S. Hussein 1990 24 p
(DE91-639966; IFUSP-P-860) Avail: NTIS HC/MF A03

Calculations have been made of the elastic scattering of Li-11 + C-12 at E/A = 30 and 85 MeV as an example of the scattering to be expected for 'exotic' neutron-rich light nuclei. The real optical potential was generated from a folding model using Hartree-Fock densities for Li-11. A variety of assumptions for the absorptive imaginary potential were explored, subject to the important constraint that the predicted reaction cross section remain reasonable. Contrary to some expectations, we provide evidence that these weakly bound systems do not exhibit the diffractive type of scattering that is characteristic of strong absorption. If anything, their more diffuse real potentials can result in an enhancement of the refractive features. DOE

N92-15723# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
ON THE THEORY OF PROTON BEAM MULTITURN EXTRACTION WITH BENT SINGLE CRYSTAL
V. M. Biryukov 1990 13 p
(DE91-640403; IHEP-OP-90-44; IFVE-OP-90-44) Avail: NTIS HC/MF A03

The efficiency of high-energy proton beam extraction with a crystal deflector under particle multiturn passage conditions is considered. It is shown, that multiturn passage increases significantly the extraction efficiency; partly, deflector angular acceptance is wider than channeling critical angle. Examples for 20 and 3 TeV beams are calculated. DOE

N92-15724# Academy of Sciences (USSR), Leningrad. Inst. Yadernoj Fiziki.
ENERGY DESCRIPTION SPECTRA FROM NUCLEAR REACTIONS IN THIN SILICON SURFACE-BARRIER DETECTORS IRRADIATED BY 1 GeV PROTONS
I. B. Vodopyanov, V. V. Miroshkin, V. F. Morozov, V. V. Pashuk, and M. G. Tverskoj 1990 11 p In RUSSIAN; ENGLISH summary
(DE91-640697; LIYaF-1593) Avail: NTIS HC/MF A03

Energy deposition spectra from reactions of protons with Si nuclei in 17.6 and 19.7 micron surface-barrier detectors are measured. Experimental data are compared with calculations based on an intranuclear cascade model with tracing the particle trajectory in the detector volume. It is shown that the algorithm developed predicts both the shape of the experimental spectrum and the total yield of events. DOE

N92-15725# Institute of Nuclear Physics, Krakow (Poland).
POSSIBLE PARAMETRIZATION OF PARTON DISTRIBUTIONS
J. Kwiecinski and D. Strozik-Kotlorz 1990 15 p
(DE91-641761; INP-1502/PH) Avail: NTIS HC/MF A03

The gluon and quark distributions of the nucleon are evaluated using the Altarelli-Parisi equations with the input distributions at Q sub 0/ exp 2 = 5 GeV(exp 2) for sea-quarks and gluons modified by the factor (ax(exp -0.5)+b). The new parametrization incorporates singular small-x behavior implied by bare Pomeron in QCD and provides consistent with large-x experimental data results as well. The theoretical predictions relevant for HERA for structure functions in the region of very small x (10 exp -4 less than x less than 10 exp -2) and large Q(exp 2) and for the cross-section sigma (gamma sup * p yields PSICHI) are presented. DOE

N92-15726# Institute of Nuclear Physics, Krakow (Poland).
ELASTIC SCATTERING AND INELASTIC DIFFRACTION
A. Malecki Dec. 1990 17 p
(DE91-641771; INP-1527/PH) Avail: NTIS HC/MF A03

An approach to diffraction based on the concept of equivalence of states is developed. The application to elastic and inclusive inelastic diffraction of high energy hadrons is very successful. The term which gives rise to a single minimum in the elastic cross-section turns out to be responsible also for the shape of the inclusive inelastic cross-section near forward direction. DOE

N92-15727# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
DIQUARK CONTRIBUTIONS TO THE NUCLEON DEEP INELASTIC STRUCTURE FUNCTIONS
M. Anselmino, F. Caruso, E. Leader, and J. Soares (Universidade do Estado do Rio de Janeiro, Brazil) 1990 15 p
(DE91-641806; CBPF-NF-024/90) Avail: NTIS HC/MF A03

The contributions of diquarks to the nucleon structure functions are discussed in the framework of the parton model and in the most general case of both vector and scalar diquarks inside unpolarized and polarized nucleons. The vector diquark anomalous magnetic moment and the scalar-vector and vector-scalar diquark transitions are also taken into account. The properties of the diquarks and of their form factors, required in order for the resulting scaling violations to be compatible with the observed ones, are discussed. DOE

N92-15728# Institute of Nuclear Physics, Krakow (Poland).
TWO-CLUSTER SPECTROSCOPIC AMPLITUDES FOR 1p-SHELL NUCLEI
Jan Kisiel and Edward Kwasniewicz 1990 34 p
(DE91-641838; INP-1521/PL) Avail: NTIS HC/MF A03

Theory of the spectroscopic amplitudes for separation of two clusters with the mass numbers less than or = to 4 from 1p-shell nuclei is presented. This theory is applied for calculating of the spectroscopic amplitudes for the decomposition of 1p-shell nuclei into the core nucleus, an alpha-particle and a nucleon. DOE

N92-15729# Institute of Nuclear Physics, Krakow (Poland).
ANALYSIS OF PROTON AND ANTIPROTON INTERACTIONS ON NUCLEI AT BEAM ENERGY 120 GeV
M. Rozanska 1991 78 p In POLISH; ENGLISH summary
(DE91-641913; INP-1524/PH) Avail: NTIS HC/MF A05

I present results of the experiment analyzing proton and antiproton inclusive reactions: p + A yields p + X, antiproton + A yields antiproton + X, p + A yields antiproton + X, antiproton

+ A yields p + X (A=Be,Cu,Ag,W,U), at beam energy 120 GeV. The results are compared with multiple collision models and wounded quark models. For all targets I have observed that the production of antiprotons is less abundant than that of protons. Differences between leading proton and antiproton are consistent with multiple collision models and with increase of probability of annihilation in a multiple interaction. Extracted annihilation cross section in a single collision is consistent with the difference between pp-bar and pp inelastic cross sections at energy 120 GeV. I also observe a stronger production of protons than antiprotons by a beam with opposite baryon number. Dual Parton Model describes properly these differences, including the weak A-dependence, and explains them as a result of target fragmentation into a forward hemisphere. Among analysed models, this model gives the best description of all observed characteristics of the data. DOE

N92-15730# Institute of Nuclear Physics, Krakow (Poland).
ENERGY AND ANGULAR DISTRIBUTIONS OF THE PROJECTILE LIKE FRAGMENTS EMITTED FROM Ar-40 + Tb-159 REACTION AT THE ENERGY 9.75 MeV/n
E. Kozik, A. Budzanowski, M. Buergel, H. Homeyer, and J. Uckert (Hahn-Meitner-Inst. G.m.b.H., Berlin, Germany, F.R.) 1990 23 p
(DE91-641931; INP-1517/PL) Avail: NTIS HC/MF A03

Energy spectra and angular distributions have been measured for projectile like fragments (PLF) of charge Z equals 6-20 produced in the bombardment of Tb-159 by Ar-40 beam energy 9.75 MeV/n. Measurements were performed at different laboratory angles ranging from 11 deg to 41 deg. Differential cross sections of the deep inelastic (DI) and quasi-elastic (QE) components are obtained. The energy integrated DI and QE angular distributions are of the exponential form for all PLF masses. Characteristic lifetimes of dinuclear systems (DNS) in exit channels are extracted from the data. DOE

N92-15731# Japan Atomic Energy Research Inst., Tokai.
MEASUREMENT OF DOUBLE-DIFFERENTIAL NEUTRON EMISSION CROSS SECTIONS OF U-238, Th-232 AND C-12 FOR18 MeV NEUTRONS
Mamoru Baba, Shigeo Matsuyama, Takuya Ito, Nobuo Ito, Kazuto Maeda, and Naohiro Hirakawa (Tohoku Univ., Sendai, Japan) Apr. 1991 37 p
(DE91-790974; JAERI-M-91-059) Avail: NTIS HC/MF A03

Double-differential neutron emission cross sections of U-238, Th-232, C-12 have been measured for 18-MeV incident neutrons using the neutron time-of-flight technique and Tohoku University 4.5MV Dynamitron accelerator as a pulsed neutron generator. In the experiment, energy resolution of the spectrometer was improved by employing a newly developed post-acceleration beam-chopper and by adjustment of timing property of the neutron detector. Measurements were made at laboratory angles between 30- and 145- deg., and data were obtained for secondary neutrons between 0.8 and 18 MeV. In the data processing, care was taken with the data correction for the effects of parasitic neutrons associated with primary neutrons; the correction proved to be of special importance in the present measurement. We compared the data obtained in the present experiment with the evaluated data, JENDL-3 and ENDF/B-IV (B-V for C-12), and discussed the origin of the discrepancies. The anisotropy observed for secondary neutrons from U-238 and Th-232 was found to be reproduced by Kalbach-Mann systematics on the assumption of isotropy of fission neutrons. The experimental results for C-12 showed marked discrepancies concerning the scattering cross sections and neutron spectrum in the continuum region. DOE

N92-15732# Japan Atomic Energy Research Inst., Tokyo.
DEVELOPMENT OF A NEGATIVE ION MEASUREMENT PROBE AND INITIAL RESULTS OF EXPERIMENTS
Kazuhiro Watanabe, Takashi Inoue, Hiroaki Kojima, Yasuhiro Matsuda, and Yoshikazu Okumura Dec. 1990 22 p In JAPANESE; ENGLISH summary Prepared in cooperation with Japan Atomic Energy Research Inst., Ibaraki
(DE91-780244; JAERI-M-90-219) Avail: NTIS HC/MF A03

A negative ion probe for the measurement of extractable negative ion currents in a plasma has been developed and tested. This probe was designed in accordance with the single aperture of the negative ion source accelerator developed at JAERI. The probe consists of a plasma electrode, an extraction electron in which a pair of permanent magnets is inserted for the electron suppression, and an ion collective cup. At first, we confirmed the accuracy of the measurement by comparing the measured value with the H(-) current actually extracted in a small negative ion source. Then the negative ion current in the ECR ion source was measured. After these experiments, it was confirmed that the probe is effective for comparing the extractable negative ion current in various ion sources and for the measurement of spatial distribution of negative ions in a plasma. DOE

N92-15733# Indiana Univ., Bloomington. Dept. of Physics.
THEORETICAL PARTICLE PHYSICS
S. A. Gottlieb, A. W. Hendry, V. A. Kostelecky, and D. B. Lichtenberg Apr. 1991 46 p
(Contract DE-AC02-84ER-40125)
(DE92-002591; DOE/ER-40125/28) Avail: NTIS HC/MF A03

During the past year, we have carried out research in the areas of lattice gauge theory, superstring theory and supersymmetry, the solar neutrino puzzle, and phenomenological models to describe the properties of hadrons. In this report, we summarize our principal accomplishments in each of these areas. DOE

N92-15734# Oak Ridge National Lab., TN.
CALCULATED THICKNESS OF TUNGSTEN ALLOY REQUIRED FOR SPECIFIED ATTENUATION OF GAMMA RADIATION FROM Cs-137
M. M. Chiles, G. W. Allin, and J. V. Pace, III 1991 5 p Presented at the Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC05-84OR-21400)
(DE92-002706; CONF-911106-6) Avail: NTIS HC/MF A01

The traditional method of evaluating and calibrating health physics instruments is to use a calibrator that consists of a single high-activity gamma radiation source with different attenuators to select the radiation level desired for testing. To have accurate radiation intensities inside the calibrator cavity, the attenuators must be designed from precise absorption calculations. This paper reports calculations made to determine the thickness of tungsten alloy metal required for specific attenuation. These calculations include the buildup contribution by secondary scattering radiation, and they are compared to values calculated with the buildup factor omitted. DOE

N92-15874*# Oakwood Coll., Huntsville, AL. Dept. of Biological Sciences.
VISUALIZATION OF DNA MOLECULES IN TIME DURING ELECTROPHORESIS
Seth Lubega *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N92-15735 Politecnico di Milano (Italy). Dipt. di Elettronica.
PID: PREDICTIVE AND FUZZY TEMPERATURE CONTROL FOR NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY EXPERIMENTS
A. Cristoforetti (Master School CEFRIEL, Milan, Italy), P. Grossi,

and R. Scattolini 1990 33 p Sponsored by MURST
(Rept-90-063; ETN-91-90246) Avail: Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

Temperature control inside the probe of a Nuclear Magnetic Resonance (NMR) spectrometer is addressed. A simple model of the system is derived starting from a series of step response experiments. A Proportional Integral Derivative (PID) regulator is synthesized and applied to the real plant. Its performances not being completely satisfactory in view of the time varying plant parameters, two adaptive predictive control algorithms are implemented, namely the generalized predictive control and the constrained receding horizon predictive control. They both perform sensibly better than PID in simulation and on the real plant. A feasibility study is carried out for a fuzzy controller; its performances in simulation prevent it from being applied on the real plant.
ESA

N92-15736# California Univ., Berkeley. Lawrence Berkeley Lab.
THREE DIMENSIONAL FIELD HARMONICS
S. Caspi, M. Helm, and L. J. Laslett 30 Mar. 1991 41 p
(Contract DE-AC03-76SF-00098)
(DE92-000657; LBL-30313; SC-MAG-328) Avail: NTIS HC/MF A03

We have developed a harmonic representation for the three dimensional field components within the windings of accelerator magnets. The form by which the field is presented is suitable for interfacing with other codes that make use of the 3D field components (particle tracking and stability). The field components can be calculated with high precision and reduced cup time at any location (r,(theta),z) inside the magnet bore. The same conductor geometry which is used to simulate line currents is also used in CAD with modifications more readily available. It is our hope that the format used here for magnetic fields can be used not only as a means of delivering fields but also as a way by which beam dynamics can suggest correction to the conductor geometry.
DOE

N92-15737# Superconducting Super Collider Lab., Dallas, TX.
APPLICATIONS OF DIFFERENTIAL ALGEBRA TO SINGLE-PARTICLE DYNAMICS IN STORAGE RINGS
Y. Yan Sep. 1991 82 p
(Contract DE-AC35-89ER-40486)
(DE92-001607; SSCL-500) Avail: NTIS HC/MF A05

Recent developments in the use of differential algebra to study single-particle beam dynamics in charged-particle storage rings are the subject of this paper. Chapter 2 gives a brief review of storage rings. The concepts of betatron motion and synchrotron motion, and their associated resonances, are introduced. Also introduced are the concepts of imperfections, such as off-momentum, misalignment, and random and systematic errors, and their associated corrections. The chapter concludes with a discussion of numerical simulation principles and the concept of one-turn periodic maps. In Chapter 3, the discussion becomes more focused with the introduction of differential algebras. The most critical test for differential algebraic mapping techniques - their application to long-term stability studies - is discussed in Chapter 4. Chapter 5 presents a discussion of differential algebraic treatment of dispersed betatron motion. The paper concludes in Chapter 6 with a discussion of parameterization of high-order maps.
DOE

N92-15738# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PULSE EXPLOSION ION BEAM SOURCE WITH ONE PULSE REGIME SUPPLY FOR SURFACE MODIFICATION OF MATERIALS
S. A. Korenev 1989 4 p In RUSSIAN; ENGLISH summary
(DE91-628215; JINR-R-13-89-390) Avail: NTIS HC/MF A01

A variant of an explosion ion beam source with one positive pulse supply for surface modification of materials is described. The ion source consists of a vacuum diode and pulse generator of the Arcadiev-Marx type. Residual gas pressure was p similar to 5 x 10(exp -5) torr in the diode. This sort of ion was fixed by a materials initiator anode plasma. To produce carbon ions, a carbon-fibrous initiator is used for niobium and a titanium-niobium-titanium cable with a picking copper matrix. The ions' density current regulation is realized by change of the diode gap in the correspondence with Child-Langmuir law. For carbon ions, the current density is j similar to 6 A/cm(exp 2) for voltage U similar to 100kV and j similar to 32 A/cm(exp 2) for voltage U similar to 300 kV.
DOE

N92-15739# Joint Inst. for Nuclear Research, Dubna (USSR).
FORMATION AND ACCELERATION OF HIGH-CURRENT HALLOW ELECTRON BEAM IN A MODIFIED LINEAR INDUCTION ACCELERATOR SECTION
O. V. Arkhipov, L. V. Bobyleva, V. I. Kazacha, G. I. Konnov, A. K. Krasnykh, I. V. Kuznetsov, A. Yu. Nikitskij, Eh. A. Perelshtejn, and A. I. Sidorov 1989 9 p In RUSSIAN; ENGLISH summary
(DE91-639011; JINR-R-9-89-613) Avail: NTIS HC/MF A02

This work is devoted to the questions of linear induction accelerator (LIA) creation that is intended for carrying out experiments on the generation of powerful RF radiation. Results obtained under further perfecting LIA LUEhK-20 systems are considered. The duration of voltage pulse plateau is equal to 60 ns. The peak beam power is 2 GW; the largest electric field strength under the operation is 10 kV/cm. The electron source characteristic properties are considered and applied methods are discussed.
DOE

N92-15740# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
CURRENT LIMITS FOR AXIALLY SYMMETRICAL ELECTRON BEAMS WITH NONUNIFORM CURRENT DENSITY RADIAL DISTRIBUTION [PREDELNYE TOKI AKSIALNO-SIMMETRICHNYKH EHIEKTRONNYKH PUCHKOV S NOEDNORODNYM RASPREDELENIEM PLONOSTI TOKA PO RADIUSU]
Z. A. Azovskaya, G. G. Aseev, and V. G. Papkovich 1989 10 p In RUSSIAN
(DE91-624833; KFTI-89-5) Avail: NTIS HC/MF A02

Numerical methods are used to determine values of current limits for continuous and hollow electron beams (EB) with uniform and nonuniform current density distributions over cross section during their movement in long metallic screens. The presented data covers practically the whole range of change of main geometric parameters of systems with high-current EB applied in experimental studies and can be used for preliminary estimation of current limits in lines of EB transport.
DOE

N92-15741# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Fiziki Vysokikh Ehnergij.
THE 70 GeV PROTON BEAM SPLITTING WITH A BENT SINGLE CRYSTAL
M. D. Bavizhev, N. A. Galyaev, V. N. Gres, V. V. Dudenko, V. N. Zapolskij, V. I. Kotov, R. A. Rzaev, and Yu. A. Chesnokov 1989 11 p In RUSSIAN; ENGLISH summary
(DE91-624916; IFVE-OP-89-77) Avail: NTIS HC/MF A03

The splitting of a 70 GeV proton beam at the angle of 60 mrad has been realized with the help of silicon and germanium crystals approximately 60 mm long. A possibility to use the obtained beams for carrying out two experiments simultaneously has been shown. The beam deflection efficiency is 5 x 10(exp -5).
DOE

N92-15742# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
EXTENSION OF THE TIMING SYSTEM FOR AmPS [UITBREIDING VAN HET TIMING-SYTSEEM TBV. AMPS]
Eric Heine and J. Kuijt 1991 3 p In DUTCH; ENGLISH summary
(LINO-1991-4; ETN-92-90301) Avail: NTIS HC/MF A01

The timing system of the kickers and RF system in the Amsterdam Pulse Stretcher (AmPS) storage ring were improved. The extension of AmPS requires a very precise timing of the RF station and the kicker system. The easiest realization was found

to be a parallel system. The timing system contains two more or less independent parts: the modulated timing system which delivers the normal timing systems along the installation, and the bundle synchronous timing system which is modulated with the bundle frequency. The beam on-off system was also modified. ESA

N92-15743# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
VERY STABLE PT-100 CONDITIONERS FOR TEMPERATURE MEASUREMENTS AT AmPS (91-02-04) [ZEER STABIELE PT-100 CONDITIONERS VOOR TEMPERATUURMETINGEN BIJ AMPS (91-02-04)]
J. T. vanEs and J. H. vanTrigt 1991 12 p In DUTCH
(DIGEL-1991-3; ETN-92-90303) Avail: NTIS HC/MF A03

Very stable conditioners were developed for the RF station of the Amsterdam Pulse Stretcher (AmPS) storage ring, covering a small temperature range (10 C), and suitable for a low room temperature dependence (0.001C/C). To fulfill the stability requirement (better than 0.05C) four wire measurements are performed at a platinum resistance PT100, and very stable components were used. The sensitivity of the conditioner is 1 V/C without linearization for the PT100 resistance; the measuring current is 2 mA. The circuit can be adapted for any temperature range. If a lower stability is sufficient, cheaper standard components can be used. ESA

N92-15744# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
THE HONEYCOMB STRIP CHAMBER: THE APPLICATION IN LHC/SSC EXPERIMENTS AND THE TEST RESULTS OF A PROTOTYPE
Harry vanderGraaf, Joop Buskens, Gerard Faber, Adriaan Koenig, Paul Rewiersma, and Thei Wijnen (Nijmegen Univ., Netherlands) Jun. 1991 34 p
(NIKHEF-H/91-11; ETN-92-90453) Avail: NTIS HC/MF A03

The basic elements of the Honeycomb Strip Chamber (HSC) of the Large Hadron Collider/Super conducting Super Collider (LHC/SSC) are described. The construction element of the chamber is shown. A Monte Carlo program is written to study the relation between the spatial resolution and parameters like chamber geometry, gas mixture, and angle of incidence of the particle. Prototype test results show that signal processing from three adjacent strips nearest to the track gives a spatial resolution better than 64 microns for perpendicular incident tracks. The chamber performance is only slightly affected by a magnetic field. ESA

N92-15745# Technical Research Centre of Finland, Espoo. Nuclear Engineering Lab.
VALIDATION OF THE REACTOR DYNAMICS CODE TRAB
Hanna Raety, Riitta Kyrki-Rajamaeki, and Markku Rajamaeki May 1991 35 p
(VTT-RR-729; ISBN-951-38-3976-1; ISSN-0358-5077; ETN-92-90674) Copyright Avail: NTIS HC/MF A03

The validation of the one dimensional reactor dynamics code TRAB (Transient Analysis code for BWR's) is summarized. TRAB was validated with benchmark problems, comparative calculations against independent analyses, analyses of start up experiments of nuclear power plants, and real plant transients. The initial power excursion of the Chernobyl reactor accident was calculated with TRAB. TRAB was originally designed for BWR analyses, but it can in its present version be used for various modeling purposes. The core model of TRAB can be used separately for LWR calculations. For PWR modeling the core model of TRAB was coupled to circuit model SMABRE to form the SMATRA code. The versatile modeling capabilities of TRAB were used in analyses of e.g., the heating reactor SECURE and the RBMK type reactor (Chernobyl). ESA

N92-15746# Sandia National Labs., Albuquerque, NM.
THE NEW RLA TEST STATUS
D. L. Smith, M. G. Mazarakis, P. Skogmo, L. F. Bennett, W. R. Olson, M. George, M. J. Harden, B. N. Turman, S. A. Moya, and J. L. Henderson 1991 6 p Presented at the Charged Particle Beam Conference, Silver Springs, MD, 25-27 Jun. 1991
(Contract DE-AC04-76DP-00789)
(DE91-018681; SAND-91-1932C; CONF-9106276-1) Avail: NTIS HC/MF A02

The Recirculating Linear Accelerator (RLA) is returning to operation with a new relativistic electron beam (REB) injector and a modified accelerating cavity. Upon completion of our pulsed-power test program, we will capture the injected beam on an Ion Focussed Regime (IFR) guiding channel in either a spiral or a closed racetrack drift tube. The relativistic beam will recirculate for four passes through two accelerating cavities, in phase with the ringing cavity voltage, and increase to 8--12 MeV before being extracted. We designed the METGLAS ribbon-wound core, inductively isolated, four-stage injector to produce beam parameters of 4 MeV, 10--20 kA, and 40--55 ns FWHM. The three-line radial cavity is being modified to improve the 1-MV accelerating pulse shape while an advanced cavity design study is in progress. This is a continuation of the Sandia National Laboratory program to develop compact, high-voltage gradient, linear induction accelerators. The RLA concept is based on guiding an injected REB with an IFR channel. This channel is formed from a plasma created with a low energy electron beam inside a beam line containing about 2 x 10(exp -4) Torr of argon. The REB is injected onto the IFR channel and is transported down the beamline through a water dielectric accelerating cavity based on the ET-2 design. If the round-tip path of the beam matches the period of the cavity, the REB can be further accelerated by the ringing waveform on every subsequent pass. We have installed the new REB injector because we need a higher amplitude, longer duration, flat-topped pulse shape with a colder beam than that produced by the previous injector. We made extensive use of computer simulations in the form of network solver and electrostatic field stress analysis codes to aid in the design and modifications for the new RLA. The pulsed-power performance of the RLA injector and cavity and the associated driving hardware are discussed. DOE

N92-15747# Japan Atomic Energy Research Inst., Tokyo.
CONCEPTUAL DESIGN OF THE ADVANCED MARINE REACTOR MRX
Feb. 1991 559 p In JAPANESE; ENGLISH summary
(DE91-508048; JAERI-M-91-004) Avail: NTIS HC/MF A24

Design studies on the advanced marine reactors have been done continuously since 1983 at the Japan Atomic Energy Research Institute (JAERI) in order to develop attractive marine reactors for the next generation. At present, two marine reactor concepts are being formulated. One is 100 MWt MRX (Marine Reactor X) for an icebreaker and the other is 300 kWe DRX (Deep-sea Reactor X) for a deep-sea research vessel. They are characterized by an integral type pressurized water reactor (PWR) built-in type control rod drive mechanisms, a water-filled container and a passive decay heat removal system, which realize highly passive safe and compact reactors. This paper is a detailed report including all major results of the MRX design study. DOE

N92-15748# Japan Atomic Energy Research Inst., Tokyo.
BASIC DESIGN FOR THE RF SYSTEM OF THE SYNCHROTRON IN THE LARGE SYNCHROTRON RADIATION FACILITY (SPRING-8)
Koichi Nakayama (Toshiba Corp., Kawasaki, Japan), Hiromitsu Suzuki, Eisuke Minehara, and Taikan Harami Feb. 1991 64 p In JAPANESE; ENGLISH summary
(DE91-508050; JAERI-M-91-012) Avail: NTIS HC/MF A04

The large synchrotron radiation facility (SPring-8) is planned to be built at Nishiharima in Hyogo-ken. This paper describes basic designs, its philosophy and specifications of the ratio frequency system in the synchrotron. DOE

N92-15749# Japan Atomic Energy Research Inst., Tokyo.
ITER NEUTRAL BEAM INJECTION SYSTEM
Yoshihiro Ohara, Shigeru Tanaka, and Masato Akiba (Japan Atomic Energy Research Inst., Naka.) Mar. 1991 186 p
(DE91-508098; JAERI-M-91-052) Avail: NTIS HC/MF A09

A Japanese design proposal of the ITER Neutral Beam Injection

System (NBS) which is consistent with the ITER common design requirements is described. The injection system is required to deliver a neutral deuterium beam of 75MW at 1.3MeV to the reactor plasma and utilized not only for plasma heating but also for current drive and current profile control. The injection system is composed of 9 modules, each of which is designed so as to inject a 1.3 MeV, 10 MW neutral beam. The most important point in the design is that the injection system is based on the utilization of a cesium-seeded volume negative ion source which can produce an intense negative ion beam with high current density at a low source operating pressure. The design value of the source is based on the experimental values achieved at JAERI. The utilization of the cesium-seeded volume source is essential to the design of an efficient and compact neutral beam injection system which satisfies the ITER common design requirements. The critical components to realize this design are the 1.3MeV, 17A electrostatic accelerator and the high voltage DC acceleration power supply, whose performances must be shown prior to the construction of the ITER NBI system. DOE

N92-15750# International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee.
NUCLEAR PHYSICS CONSTANTS FOR THERMONUCLEAR FUSION. A REFERENCE HANDBOOK
S. N. Abramovich, B. Ya. Guzhovskij, V. A. Zherebtsov, and A. G. Zvenigorodskij Mar. 1991 107 p Transl. into ENGLISH of handbook from Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike (Moscow, USSR), 1989
(DE91-641118; INDC(CCP)-326/L+F) Avail: NTIS HC/MF A06

Light nuclei reactions are required for a number of practical applications: they are used extensively in nuclear physics research as neutron sources, and as standards for the normalization of absolute reaction cross-sections. Nuclear reactions with light nuclei are useful in non-destructive testing and in the determination of isotopic compositions when other analytical methods are not adequate for obtaining the required information. The information presented in this handbook consists of nuclear reaction cross-sections and scattering cross-sections for the interaction of hydrogen and helium isotopes with nuclei of Z is less than or equal to 5. The evaluated integral and partial differential cross-sections presented here have been derived from a large body of compiled information, and encompass data for both exo-energetic and endo-energetic reaction channels. The evaluated data are presented in the form of sets of coefficients for fitted polynomials which ensures reliable interpolation of the data using contemporary computer methods. DOE

N92-15751# Houston Univ., TX.
MANUAL FOR COMSYN: A ORBIT INTEGRATION CODE FOR THE STUDY OF BEAM DYNAMICS IN COMPACT SYNCHROTRONS
Y. Huang Oct. 1991 9 p
(Contract DE-FG05-87ER-40374)
(DE92-002612; DOE/ER-40374/57) Avail: NTIS HC/MF A02

COMSYN is a numerical integration code which is written for the study and design of the compact synchrotrons. An improved 4th-order Runge-Kutta method is used in COMSYN to integrate the exact equations of motion in a rectangular coordinate system. The magnetic field components of the dipole B(sub x), B(sub y), and B(sub z) can be obtained from either measurement or directly computed data (MAGNUS, TOSCA). A spline interpolation method is then used to get the field value at the particle position. For standard quadrupole and sextupole, the analytical expression is employed to compute its field distribution. DOE

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N92-15752*# Alabama Univ., Huntsville. Dept. of Physics.
X RAY MICROSCOPE ASSEMBLY AND ALIGNMENT SUPPORT AND ADVANCED X RAY MICROSCOPE DESIGN AND ANALYSIS Final Report, 10 May 1990 - 30 Sep. 1991
David L. Shealy 28 Oct. 1991 30 p
(NASA Order H-06853-D)
(NASA-CR-184269; NAS 1.26:184269) Avail: NTIS HC/MF A03 CSCL 20F

Considerable efforts have been devoted recently to the design, analysis, fabrication, and testing of spherical Schwarzschild microscopes for soft x ray application in microscopy and projection lithography. The spherical Schwarzschild microscope consists of two concentric spherical mirrors configured such that the third order spherical aberration and coma are zero. Since multilayers are used on the mirror substrates for x ray applications, it is desirable to have only two reflecting surfaces in a microscope. In order to reduce microscope aberrations and increase the field of view, generalized mirror surface profiles have been considered in this investigation. Based on incoherent and sine wave modulation transfer function (MTF) calculations, the object plane resolution of a microscope has been analyzed as a function of the object height and numerical aperture (NA) of the primary for several spherical Schwarzschild, conic, and aspherical head reflecting two mirror microscope configurations. Author

N92-15753 National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
NOVEL PROBES FOR SURFACE TEXTURE METROLOGY
Jane A. Haycocks Jul. 1991 19 p Original contains color illustrations
(NPL-MOM-105; ISSN-0309-3069; ETN-92-90714) Copyright Avail: National Physical Lab., Teddington, TW11 OLW, England

The survey of novel surface texture probes is presented. It illustrates the diversity of approach and rapidity of development. The results indicate that a number of probes, in particular, capacitance, pneumatic, near field optical and optical focus detecting, have application or potential application to traceable surface texture metrology. The measurement range of interest of surface amplitudes is 0.1 nm to 50 micro-m and surface wavelengths of 0.1 nm to 100 nm. The necessary background information of procurement and further investigation of selected probe types is provided. ESA

N92-15754# Lawrence Livermore National Lab., CA.
SLIT-MOUNTED LED FIDUCIAL SYSTEM FOR ROTATING MIRROR STREAK CAMERAS
L. L. Shaw, S. A. Muelder, and A. T. Rivera 1991 7 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-002186; UCRL-JC-108495; CONF-9107115-56) Avail: NTIS HC/MF A02

We have developed a fiduçial system for rotating mirror streak cameras that utilizes light emitting diodes mounted at the slit position of the camera. The diodes are driven to the required high brightness by a unique pulse power circuit designed to provide high voltage, high current pulses 18 nanoseconds in length at a frequency of up to 2.5 megahertz. The availability of super bright light emitting diodes with a wavelength of 630 to 640 nanometers allows us to record fiducial pulses, at streaking speeds in excess of 20mm per microsecond, on all the black and white films commonly used in high speed photography. The time marks on the film record are referenced to the real time of the experiment from a clock-driver that controls the start and frequency of the fiducial pulse train and by three adjustable and discrete blanked fiducials. This paper discusses the development of this system and describes the full setup as used at LLNL. DOE

N92-15857*# Spelman Coll., Atlanta, GA. Dept. of Chemistry.
NONLINEAR OPTICAL PROPERTIES OF ORGANIC MATERIALS: A THEORETICAL STUDY
Beatriz H. Cardelino *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-088-021)
Avail: NTIS HC/MF A12 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N92-15755# National Inst. for Fusion Science, Nagoya (Japan).
DESIGN SCALINGS AND OPTIMIZATIONS FOR SUPER-CONDUCTING LARGE HELICAL DEVICES
K. Yamazaki, O. Motojima, M. Asao (Kobe Steel Ltd., Japan), M. Fujiwara, and A. Iiyoshi May 1990 45 p
(NIFS-30; ISSN-0915-633X) Avail: NTIS HC/MF A03

Scalings of plasma configurations and engineering device parameters for l equals 2 helical systems with continuous coils are derived from a wide range of computations. Using these scalings, typical optimized designs of heliotron/torsatron experimental devices with NbTi superconducting (SC) coils are obtained after maximizing a fusion product n tau T within both physics and engineering constraints. Optimization studies have been carried out for the next-generation Large Helical Device (LHD) having a major radius of approx. 4 m and magnetic field of approx. 4 Tesla, in which to demonstrate a divertor concept is one of key experiments. These studies clarified that higher gamma c (helical coil pitch parameter) configurations (gamma c approx. greater than 1.25) with a larger plasma minor radius are not acceptable from the requirement of the clean divertor configuration. More compact lower-m systems (m approx. less than 8) are bounded by the equilibrium beta limit of the plasma and the stability limit of the SC coil current due to higher maximum magnetic field strength. Larger-aspect-ratio larger-m systems (m approx. greater than 12, gamma c is approx. 1.2-1.3) with better neoclassical confinement properties are not effective because of lower stability beta and a narrower clearance between the divertor layer and the wall. The divertor clearance becomes more severe in normal-conducting (NC) designs than in SC systems, and more than 5-second plasma operations are not possible. An l equals 2/m equals 10/gamma equals 1.2 SC system is found as one of optimized high n tau T configurations for 4m/4T next-generation experiments with respect to the high-beta requirement, the clean divertor installation, the SC coil engineering and the cost optimization. Author

N92-15756# National Inst. for Fusion Science, Nagoya (Japan).
PLASMA SPECTROSCOPY AND ATOMIC PROCESSES
Sep. 1990 180 p Workshop held in Nagoya, Japan, 14-15 May 1990
(DE91-767928; NIFS-PROC-4; CONF-9005341) Avail: NTIS HC/MF A09

The papers from the workshop held at the Data and Planning Center of the National Institute for Fusion Science (NIFS) are presented. The 18 papers are discussed individually. The following topics are discussed: plasma spectroscopy, high temperature plasmas, highly charged ions, two electron systems, and muon catalyzed fusion. DOE

N92-15757# Mississippi State Univ., Mississippi State. Diagnostic Instrumentation and Analysis Lab.
DIAGNOSTIC DEVELOPMENT AND SUPPORT OF MHD TEST FACILITIES
1990 64 p
(Contract DE-AC02-80ET-15601)
(DE92-000632; DOE/ET-15601/40; FE-15601-40) Avail: NTIS HC/MF A04

The Diagnostic Instrumentation and Analysis Laboratory (DIAL) at Mississippi State University (MSU) is developing diagnostic instruments for Magnetohydrodynamic (MHD) power train data acquisition and for support of MHD component development test facilities. Microprocessor-controlled optical instruments, initially developed for Heat Recovery/Seed Recovery support, are being refined, and new systems to measure temperatures and gas-seed-slag stream characteristics are being developed. To further data acquisition and analysis capabilities, the diagnostic systems are being interfaced with DIAL's computers. Technical support for the diagnostic needs of the national MHD research effort is being provided. DIAL personnel will also cooperate with government agencies and private industries to improve the transformation of research and development results into processes, products, and services applicable to their needs. DOE

N92-15758# Oak Ridge National Lab., TN.
ITER PHYSICS DESIGN GUIDELINES AT HIGH ASPECT RATIO
N. A. Uckan 1991 5 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000729; CONF-910968-11) Avail: NTIS HC/MF A01

The physics requirements for the International Thermonuclear Experimental Reactor (ITER) design are formulated in a set of physics design guidelines. These guidelines, established by the ITER Physics Group during the Conceptual Design Activity (CDA, 1988--90), were based on credible extrapolations of the tokamak physics database as assessed during the CDA, and defined a class of tokamak designs (with plasma current I is approximately 20 MA and aspect ratio A is approximately 2.5--3.5) that meet the ITER objectives. Recent U.S. studies have indicated that there may be significant benefits if the ITER-CDA design point is moved from the low aspect ratio, high current baseline (A = 2.79, I = 22 MA) to a high aspect ratio machine at Ais approximately 4, I is approximately 15 MA, especially regarding steady-state, technology-testing performance. To adequately assess the physics and technology testing capability of higher aspect ratio design options, several changes are proposed to the original ITER guidelines to reflect the latest developments in physics understanding at higher aspect ratios. The critical issues for higher aspect ratio design options are the uncertainty in scaling of confinement with aspect ratio, the variation of vertical stability with elongation and aspect ratio, plasma shaping requirements, ability to control and maintain plasma current and q-profiles for MHD stability (and volt-second consumption), access for current drive, restrictions on field ripple and divertor plate incident angles, etc. DOE

N92-15759# Oak Ridge National Lab., TN.
PLASMA SHAPE CONTROL CALCULATIONS FOR BPX DIVERTOR DESIGN
D. J. Strickler, G. H. Neilson, S. C. Jardin, and N. Pomphrey (Princeton Univ., NJ.) 1991 4 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000731; CONF-910968-13) Avail: NTIS HC/MF A01

The Burning Plasma Experiment (BPX) divertor is to be capable of withstanding heat loads corresponding to ignited operation and 500 MW of fusion power for a current rise time and flattop lasting several seconds. The poloidal field (PF), diagnostic, and feedback equilibrium control systems must provide precise X-point position control in order to sweep the separatrices across the divertor target surface and optimally distribute the heat loads. A control matrix magnetohydrodynamic (MHD) equilibrium code, BEQ, and the Tokamak Simulation Code (TSC) are used to compute preprogrammed double-null (DN) divertor sweep trajectories that maximize sweep distance while simultaneously satisfying a set of strict constraints: minimum lengths of the field lines between the X-point and strike points, minimum spacing between the inboard plasma edge and the limiter, maximum spacing between the outboard plasma edge and the ICRF antennas, minimum safety factor, and linked poloidal flux. A sequence of DN diverted equilibria

and a consistent TSC fiducial discharge simulation are used in evaluating the performance of the BPX divertor shape and possible modifications. DOE

N92-15760# Martin Marietta Energy Systems, Inc., Oak Ridge, TN.
THE EFFECT OF THE HIGH-ASPECT-RATIO DESIGN PARAMETERS ON ITER CONTAINMENT STRUCTURES
B. E. Nelson, D. L. Conner, P. J. Fogarty, G. H. Jones, D. C. Lousteau, and D. E. Williamson 1991 4 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000736; CONF-910968-16) Avail: NTIS HC/MF A01

The containment structures for the International Thermonuclear Experimental Reactor (ITER) include the plasma vacuum vessel, the structural supports for the in-vessel components, the gravity supports for the vacuum vessel and magnet system, the passive stabilizing structure, the internal fast active coils, and the cryostat vacuum vessel. Reference design concepts for all of these components have been prepared as part of the ITER Conceptual Design Activity (CDA), for the standard ITER design point: Aspect ratio of 2.8, major radius of 6 m, central toroidal field of 4.8 T, and peak plasma current of 22 MA. A proposal has been made to improve the performance of ITER by modifying the reference design point. The high-aspect-ratio design (HARD) proposal increases the aspect ratio to 4, increases the central toroidal field to 7 T, and decreases the peak plasma current to 14.8 MA. Systems studies indicate that the HARD parameters provide improved technology testing capability by increasing the neutron wall loading while maintaining the CDA physics constraints (beta limit, energy confinement, etc.). Changes in configuration, loading, stresses, and other factors for the containment structures components, based on the HARD parameters, have been investigated. The effects of these changes, both positive and negative, are discussed. DOE

N92-15761# Oak Ridge National Lab., TN.
SCOPING STUDIES FOR SMALL STEADY-STATE TOKAMAKS FOR DIVERTOR TESTING
J. D. Galambos, Y. K. M. Peng, B. E. Nelson, S. P. Hirshman, and P. J. Fogarty 1991 6 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000740; CONF-910968-10) Avail: NTIS HC/MF A02

A prime uncertainty in next-generation devices is the divertor performance. For the International Thermonuclear Experimental Reactor (ITER), the divertor limit often plays a more critical role in the operational scenario definition than do beta limit and energy confinement constraints. Hence, it is desirable to test the divertors in an environment as close as possible to that expected in next-step burning plasma experiments. Initial global scoping studies are done for small, steady-state, copper coil, beam-driven tokamaks that are dedicated to divertor testing. The usual ITER global physics models (beta limit, energy confinement, and analytic divertor heat load calculation) are incorporated, and for performance criteria we require that the divertor heat load and plasma collisionality in the edge region be similar to those expected in ITER. The smallest, lowest-cost devices satisfying these constraints tend to have major radius below 1 m, plasma current of 0.5 to 1 MA, and low aspect ratio and costs of a few tens of millions of dollars. Injection powers of about 4 to 5 MW are needed to sustain the plasma current, maintain plasma power balance, and provide the required divertor heat load. DOE

N92-15762# Oak Ridge National Lab., TN.
RAY TRACING AND ABSORPTION OF ELECTRON CYCLOTRON WAVES IN THE L-2 STELLARATOR
R. C. Goldfinger, K. M. Likin, and B. D. Ochirov (Academy of Sciences, USSR, Novosibirsk) 1991 4 p Presented at the 9th Topical Conference on Radio Frequency Power in Plasmas, Charleston, SC, 12-14 Aug. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000741; CONF-910869-14) Avail: NTIS HC/MF A01

The absorption of electron cyclotron waves in L-2 stellarator plasmas has been investigated by adapting the RAYS geometrical optics code developed at Oak Ridge National Laboratory to the parameters of L-2. Two heating schemes were considered: Low-field launching of the ordinary wave at the fundamental resonance and low-field launching of the extraordinary wave at the second harmonic. Significant power absorption (up to 100 percent) of the extraordinary mode at the second harmonic resonance was obtained. A multipass absorption model was used to estimate the contribution to plasma heating of the power that remains after the first pass which is subsequently reflected from the vessel walls. Finally, results obtained with the RAYS code and with a code developed at the Institute of Automation and Electrometry were compared and found to be in good agreement. DOE

N92-15763# Oak Ridge National Lab., TN.
MECHANICAL DESIGN ISSUES ASSOCIATED WITH MOUNTING, MAINTENANCE, AND HANDLING OF AN ITER DIVERTOR
P. L. Goranson, P. J. Fogarty, and G. H. Jones 1991 5 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-000742; CONF-910968-12) Avail: NTIS HC/MF A01

Several designs that address plasma-facing plate configurations and thermal-hydraulic design issues have been developed for the ITER divertor. Design criteria growing out of physics requirements, physical constraints, and remote handling requirements impose severe mechanical requirements on the support structure and its attachments. These pose a challenge to the mechanical design of a divertor, which must be addressed before a functional divertor is practical -- that is, one that can be remotely handled, aligned, and maintained; that functions reliably under thermal loading and disruptions; and that gives the required life in the nuclear environment predicted for ITER. This paper discusses the design criteria for the divertor mounting structure and identifies the mechanical design issues that need to be addressed. Achieving the criteria may require the development of new components and innovative configurations, specifically a new class of remote fasteners and electrically resistant material for mounts. The possible design of such components and an R&D program to develop them are described, and issues specific to the high-aspect-ratio design (HARD) configuration are summarized. Analysis and experiments that will resolve these issues and concerns and lead to a final ITER design are identified. DOE

N92-15764# Illinois Univ., Urbana. Fusion Studies Lab.
CTR PLASMA ENGINEERING STUDIES
George H. Miley 1991 97 p
(Contract DE-FG02-86ER-52127)
(DE92-000761; DOE/ER-52127/81) Avail: NTIS HC/MF A05

Ash (e.g., thermalized helium from D-T) buildup in a tokamak can potentially prevent ignition and seriously degrade the fusion energy gain from driven system. This problem is most pronounced as the ratio of particle/energy confinement time increases towards the neoclassical limit. Yet much improved confinement of the fuel ions is desirable for a fusion reactor. The goals of the work described here were two fold: to study the effect of helium buildup on the energy balance for a tokamak, and consider methods of active control that might be employed to alleviate the problem. We examine ash buildup effect for both D-T and D-(3)He systems. Most examples used apply to the ARIES 1 D-T reactor design and to the ARIES 3 D-(3)He design since part of this was in support of these two designs. Then we report on brief studies of two potentially attractive control methods, namely controlled sawtooth and fishbone instabilities. The concept is that sawteeth or fishbones would be used on purpose periodically in order to 'flush' out excess ash from the fusion core. Both methods are shown to feasible and attractive. More study is needed, however,

since the phenomenona are physically complex. Still the pay off, namely, reduced ash buildup, is important so such studies deserves strong attention. DOE

N92-15765# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
INDUCTIVELY COUPLED PLASMA OPTICAL EMISSION SPECTROMETRY ANALYSIS OF LANTHANUM, SAMARIUM AND GADOLINIUM OXIDES FOR RARE EARTHS IMPURITIES
L. C. P. Reino and A. R. Lordello Sep. 1990 22 p In PORTUGUESE; ENGLISH summary
(DE91-634762; IPEN-PUB-317) Avail: NTIS HC/MF A03

An inductively coupled plasma optical emission spectrometry method is described for the determination of Sm, Eu, La, Gd, Dy, Pr, Ho, Nd, Tb and Y in purified oxides of lanthanum, samarium and gadolinium. The method enables a simple, precise, and readily available determination. Dissolution of the samples is achieved with diluted hydrochloric acid (1:1). The solutions are diluted to volume for a concentration of 1 mg/ml.The lowest determination limit is 0.01 percent for most elements and 0.05 or 0.1 percent for a few rare earths in samarium and gadolinium matrices. Lanthanum, Samarium and Gadolinium concentrates with purity grade of 99.9 percent, 99.6 percent, and 99.8 percent, respectively, can be analysed by this procedure. DOE

N92-15766# Academy of Sciences (USSR), Novosibirsk. Inst. Yadernoj Fiziki.
ION DISTURBANCE DEVELOPMENT, DOUBLE LAYERS, AND STOCHASTIC EFFECTS
N. S. Buchelnikova and E. P. Matochkin 1990 53 p In RUSSIAN; ENGLISH summary
(DE91-636637; IYAF-90-24) Avail: NTIS HC/MF A04

The numerical experiments (Particle In Cell method) were made to study the motion of low initial energy electrons during evolution of ion perturbation, which models the final stage of the modulational instability of the Langmuir wave, or of the ion perturbation which is formed during evolution of the modulational instability. The evolution of the ion perturbation leads to the alteration of the potential distribution and to the temporal formation of the electric double layers on edges of the perturbation. This leads alternately to the trapping and detrapping of electrons. This essential role also leads to the interaction of the electrons with the double layers (acceleration, deceleration of reflection of the electrons). These processes lead to the stochastization of the electron motion. DOE

N92-15767# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
THE COMMENTS OF THE COLD NUCLEAR FUSION
K. D. Tolstov 1989 4 p In RUSSIAN; ENGLISH summary
(DE91-628493; JINR-R-15-89-338) Avail: NTIS HC/MF A01

Some possibilities of the 'cold' nuclear fusion have been examined. The juxtaposition of the publicated data and the presence of the contradictions between them have been presented. The variant of the experiment has been proposed. DOE

N92-15768# Academy of Sciences of the Ukrainian SSR, Kharkov. Fiziko-Tekhnicheskij Inst.
COLLECTIVE INTERACTION OF MONOENERGETIC RELATIVISTIC HIGH-ENERGY ELECTRON BEAMS WITH PLASMA [KOLLEKTIVNOE VZALMODEJSTVIE MONOEHNERGETICHESKIKH REHP BOLSHOJ EHNERGII S PLAZMOJ]
A. K. Berezin, V. A. Kiselev, I. N. Onishchenko, and Ya. B. Fajnberg 1989 16 p In RUSSIAN
(DE91-623756; KFTI-89-3) Avail: NTIS HC/MF A03

Results of the experimental and theoretical investigations of the interactions of modulated relativistic electron beams (REB) with plasma and monoenergetic REB with dense plasma are presented. Coherent energy losses of modulated relativistic beam and excitation of collective oscillations in plasma by the beam conditioned by the Vavilov-Cherenkov effect are revealed. It is shown that the efficiency of the interaction of monoenergetic REB with low angular divergence with the plasma does not decrease as plasma density grows. DOE

N92-15769# Grumman Aerospace Corp., Princeton, NJ. Corporate Research Center.
HIGH BETA AND SECOND STABILITY REGION TRANSPORT AND STABILITY ANALYSIS
Sep. 1991 38 p
(Contract DE-FG02-89ER-51124)
(DE92-001803; DOE/ER-51124/T3) Avail: NTIS HC/MF A03

This document describes ideal and resistive MHD studies of high-beta plasmas and of the second stability region. Significant progress is reported on the resistive stability properties of high beta poloidal 'supershot' discharges. For these studies initial profiles were taken from the TRANSP code which is used extensively to analyze experimental data. When an ad hoc method of removing the finite pressure stabilization of tearing modes is implemented it is shown that there is substantial agreement between MHD stability computation and experiment. In particular, the mode structures observed experimentally are consistent with the predictions of the resistive MHD model. We also report on resistive stability near the transition to the second region in TFTR. Tearing modes associated with a nearby infernal mode may explain the increase in MHD activity seen in high beta supershots and which impede the realization of Q approximately = 1. We also report on a collaborative study with PPPL involving sawtooth stabilization with ICRF. DOE

N92-15770# International Centre for Theoretical Physics, Trieste (Italy).
CHEMICALLY REACTING FLOW OF A COMPRESSIBLE THERMALLY RADIATING TWO-COMPONENT PLASMA
A. R. Bestman Dec. 1990 14 p
(DE91-641684; IC-90/468) Avail: NTIS HC/MF A03

The paper studies the compressible flow of a hot two-component plasma in the presence of gravitation and chemical reaction in a vertical channel. For the optically thick gas approximation, closed form analytical solutions are possible. Asymptotic solutions are also obtained for the general differential approximation when the temperature of the two bounding walls are the same. In the general case, the problem is reduced to the solution of standard nonlinear integral equations which can be tackled by iterative procedure. The results are discussed quantitatively. The problem may be applicable to the understanding of the explosive hydrogen-burning model of solar flares. DOE

N92-15771# Japan Atomic Energy Research Inst., Tokyo.
THE ENERGY CONFINEMENT SCALING BASED ON MICROTURBULENCE TRANSPORT AND NEOCLASSICAL CONDUCTIVITY IN A TOKAMAK
Masatoshi Yagi (Japan Atomic Energy Research Inst., Naka.) Mar. 1991 15 p
(DE91-508053; JAERI-M-91-022) Avail: NTIS HC/MF A03

Based on the neoclassical electric conductivity and the anomalous transport models due to trapped electron modes and ion temperature gradient modes, the scaling law of the global energy confinement time in a tokamak has been theoretically studied, under the electron temperature profile constraint. The entropy production rate method, developed by W.M. Tang, has been employed to evaluate the electron temperature at the magnetic axis. The calculations has been performed in the wide range of the surface safety factor q(sub a) of 2 to 7 and the inverse aspect ratio a/R of 0.2 to 0.6. Results are tau(sub E)(infinity)n(sub e)q(sub a)(exp 0.9) a(exp 0.9)R(exp 1.9)B(exp -0.3) for joule heated plasmas and tau(sub E)(infinity)n(sub e)(exp 0.6)I(sub p) (exp 1.16)a(exp 0.15)R(exp 1.7) B(exp -0.36)P(exp -0.6) for additionally heated L-mode plasmas, respectively. The trapped particle effect, or neoclassical effect, on electric conductivity has been shown to increase the dependence of q(sub a) on tau(sub E), compared with the results for Spitzer conductivity case. Both scaling laws for joule and additionally heated plasmas are similar to those obtained in experiments. DOE

N92-15772# Japan Atomic Energy Research Inst., Tokyo.
VACUUM COMPONENT SUBSYSTEM OF TV THOMSON SCATTERING SYSTEM IN JFT-2M
Tomio Shiina, Toshihiko Yamauchi (Japan Atomic Energy Research Inst., Naka.), Atsushi Fujisawa, Osamu Hanawa, D. Dimock, Akira Takahashi, and Shinji Inomata Mar. 1991 22 p In JAPANESE; ENGLISH summary
(DE91-508079; JAERI-M-91-030) Avail: NTIS HC/MF A03

The vacuum component subsystem, which is one of six subsystems in the TV Thomson scattering (TVTS) system for the JFT-2M tokamak, is completed under a US-JAPAN cooperative program. This subsystem is composed of top and bottom flanges, side flange, beam dump, viewing dump and so on. These components are fitted in the existing 13-point Thomson scattering system as well as the TVTS optics newly developed by Princeton Plasma Physics Laboratory (PPPL) in the USA. A new feedback system of laser beam alignment was designed and developed. DOE

N92-15773# Japan Atomic Energy Research Inst., Tokyo.
THE ROLE OF INTEGER-MODE RATIONAL SURFACE ON PEAKED PROFILE FORMATION IN TOROIDAL ROTATION VELOCITY AND ION TEMPERATURE
Yoshihiko Koide, Shin-Ichi Ishida, and Akira Sakasai (Japan Atomic Energy Research Inst., Naka.) Mar. 1991 13 p
(DE91-508084; JAERI-M-91-041) Avail: NTIS HC/MF A03

A particular role of integer-mode rational surfaces on the formation of peaked T sub i(r) and V sub t(r) is observed. In the case of JT-60 hot-ion regime, the plasma spontaneously changes its peaking region from the inside of a q=2 surface to that of a broader q=3 surface. DOE

N92-15774# Japan Atomic Energy Research Inst., Tokyo.
CONTROL OF THE PLASMA CONFIGURATION IN ITER
Ryuji Yoshino, Satoshi Nishio, Masayoshi Sugihara (Japan Atomic Energy Research Inst., Naka.), and Kichiro Shinya Mar. 1991 20 p
(DE91-508093; JAERI-M-91-049) Avail: NTIS HC/MF A03

Control of the plasma configuration in ITER is investigated. The multivariable noninteracting control method is proposed as one of the possible control algorithms for the plasma shape control. The relation between the control variables and the poloidal magnetic field coil currents is essential for investigating a feedback matrix gain, and is estimated for an ITER plasma. Control of the horizontal position of a plasma is investigated at the early buildup phase just after the breakdown. Poloidal field coil power supplies of 20kV and the installation of invessel coils are recommended to obtain the vertical magnetic field required for the plasma current rampup rate of 1MA/s. DOE

N92-15775# National Lab. for High Energy Physics, Tsukuba (Japan).
COMMENTS ON CRYSTAL ACCELERATORS AT KEK LIGHT SOURCES
B. Newberger Jan. 1991 11 p
(DE91-508199; KEK-90-19) Avail: NTIS HC/MF A03

We consider several concepts which have been proposed for particle acceleration in crystalline solids in terms of proof-of-principle experiments using available sources of light from the VUV to X ray. Direct evidence of acceleration does not appear to be observable but, in some cases, it may be possible to infer the presence of the waves which can provide a gradient. DOE

N92-15776# Japan Atomic Energy Research Inst., Tokyo.
ANALYSIS OF OPERATION AND MAINTENANCE IN JT-60
Kiyotsugu Arakawa, Munetaka Seimiya, and Masatsugu Shimizu Dec. 1990 63 p In JAPANESE; ENGLISH summary Prepared in cooperation with Japan Atomic Energy Research Inst., Ibaraki
(DE91-780248; JAERI-M-90-226) Avail: NTIS HC/MF A04

Operation in a large tokamak device, JT-60, was carried out for about five years since its first plasma was obtained in April of 1985. The total number of shots amounts to about 9000, including both ohmic heating and additional heating shots. Many troubles were reported in this period. The trouble analysis gives us a lot of useful information on the availability and reliability of the JT-60 facilities. Some effective countermeasures have been developed to reduce the troubles and to raise the operational efficiency. The JT-60 has been under construction for its upgrade since November of 1989. The results of trouble analysis will be useful for us to plan the operation and maintenance of the JT-60 upgrade and the design of the Fusion Experimental Reactor. DOE

N92-15777# Argonne National Lab., IL.
BOOTSTRAP AND FAST WAVE CURRENT DRIVE FOR TOKAMAK REACTORS
D. A. Ehst Sep. 1991 15 p Presented at the International Workshop on Fast Wave Current Drive in Reactor Scale Tokamaks Synergy and Complementarity With LHCD and ECRH, Cadarache (France), 23-25 Sep. 1991
(Contract W-31-109-eng-38)
(DE92-001981; ANL/CP-72944; CONF-9109200-3) Avail: NTIS HC/MF A03

Using the multi-species neoclassical treatment of Hirshman and Sigmar, we study steady state bootstrap equilibria with seed currents provided by low frequency (ICRF) fast waves and with additional surface current density driven by lower hybrid waves. This study applies to reactor plasmas of arbitrary aspect ratio. In one limit, the bootstrap component can supply nearly the total equilibrium current with minimal driving power (less than 20 MW). However, for larger total currents considerable driving power is required (for ITER: I(sub o) = 18 MA needs P(sub FW) = 15 MW, P(sub LH) = 75 MW). A computational survey of bootstrap fraction and current drive efficiency is presented. DOE

N92-15778# Wisconsin Univ., Madison. Center for Plasma Theory and Computation.
INTERACTION OF BOOTSTRAP-CURRENT-DRIVEN MAGNETIC ISLANDS
C. C. Hegna and J. D. Callen Oct. 1991 37 p
(Contract DE-FG02-86ER-53218)
(DE92-002625; UW-CPTC-91-16) Avail: NTIS HC/MF A03

The formation and interaction of fluctuating neoclassical pressure gradient driven magnetic islands is examined. The interaction of magnetic islands produces a stochastic region around the separatrices of the islands. This interaction causes the island pressure profile to be broadened, reducing the island bootstrap current and drive for the magnetic island. A model is presented that describes the magnetic topology as a bath of interacting magnetic islands with low to medium poloidal mode number (m approximately = 3-30). The islands grow by the bootstrap current effect and damp due to the flattening of the pressure profile near the island separatrix caused by the interaction of the magnetic islands. The effect of this sporadic growth and decay of the islands ('magnetic bubbling') is not normally addressed in theories of plasma transport due to magnetic fluctuations. The nature of the transport differs from statistical approaches to magnetic turbulence since the radial step size of the plasma transport is now given by the characteristic island width. This model suggests that tokamak experiments have relatively short-lived, coherent, long wavelength magnetic oscillations present in the steep pressure-gradient regions of the plasma. DOE

N92-15883*# La Grange Coll., GA. Dept. of Physics.
A THEORETICAL STUDY OF THE STEADY STATE OF A SPACE PLASMA
Michael J. Pangia *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20I

N92-15884*# Florida Univ., Gainesville. Dept. of Physics.
STUDIES OF THE CHARGING OF A THIN DUST LAYER IN A PLASMA
Lennart R. Peterson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991

5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20I

N92-15890*# Florida International Univ., Miami. Dept. of Physics.
HIGH VOLTAGE PLASMA SHEATH ANALYSIS RELATED TO TSS-1
John W. Sheldon *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991
4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20I

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Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N92-15779# Argonne National Lab., IL.
EVALUATION OF THE TOROIDAL-TYPE SUPERCONDUCTING MAGNETIC ENERGY STORAGE SYSTEM (SMES)
Seiichiro Terai, Takuya Kishida, Taiji Minaguchi, Yoshishige Murakami, Katsuyoshi Toyota, Naohiro Doki, and Masaichi Fukada (Mitsubishi Electric Corp., Kobe, Japan) 22 Jun. 1990 6 p Presented at the 1990 National IEE Convention, Japan, 28-30 Mar. 1990
(Contract W-31-109-eng-38)
(DE91-017797; ANL-Trans-90-13; CONF-9003288-1) Avail: NTIS HC/MF A02

This study reports evaluations of the basic system of a toroidal-type superconducting magnetic energy storage system which has several MJ of magnetically stored energy. DOE

N92-15780*# Eloret Corp., Sunnyvale, CA.
SIMULATION STUDIES FOR SURFACES AND MATERIALS STRENGTH Semiannual Progress Report, 1 May - 31 Oct. 1991
Timur Halicioglu 1991 35 p
(Contract NCC2-297)
(NASA-CR-189494; NAS 1.26:189494) Avail: NTIS HC/MF A03 CSCL 20L

Investigations were carried out in the following three areas. First, a simulation study was conducted to investigate the early stages of a nucleation and growth mechanism taking place on diamond surfaces. The energetically most favorable binding sites were calculated along with the binding energies for up to three carbon atoms deposited on the planes of a diamond crystal. Secondly, calculations were carried out to analyze energies and structural properties for restructured patterns of the surface of a diamond. Two different model functions, developed recently for carbon, were employed in the calculations. Lastly, a crack propagation process for the graphitic basal plane, was investigated using a molecular dynamics technique. Interactions among carbon atoms in the system were calculated using the Tersoff potential energy function. Author

N92-15781# Institute for Defense Analyses, Alexandria, VA.
GERMANIUM REQUIREMENTS FOR NATIONAL DEFENSE
Donald A. Fink and Julia Culver-Hopper Jul. 1991 60 p
(Contract MDA903-89-C-0003)
(AD-A240992; IDA-P-2606; IDA/HQ-91-38798; AD-E501432)
Avail: NTIS HC/MF A04 CSCL 07/2

Germanium, one of the most important of the advanced electronic materials, is used in semiconductor devices, fiber optic systems, and infrared sensors for ships, aircraft, missiles, tanks and anti-tank units. Because of its importance in these applications, germanium was added to the National Defense Stockpile in the early 1980s. This study estimates the appropriate amount of germanium to be held in the stockpile, given DoD's current assumptions for stockpile planning. Because of the dearth of publicly available data on germanium supplies and demands, the analysts based these estimates on data gathered from Service Program Offices and industry and company officials throughout North America. The study was conducted in support of DoD's ongoing effort to review and update the requirements for strategic and critical materials. GRA

N92-15782# North Carolina State Univ., Raleigh.
PREVENTION OF SINGLE EVENT UPSETS IN MICROELECTRONICS Technical Report, 1 Jul. 1986 - 30 Jul. 1990
J. R. Hauser, T. R. Weatherford, S. E. Kerns, L. W. Massengill, and B. L. Bhuva 1 Aug. 1991 180 p
(Contract DNA001-86-C-0062)
(AD-A241027; SSL-024; DNA-TR-90-164) Avail: NTIS HC/MF A09 CSCL 20/12

Experimental and analytical studies of basic single-event radiation effects, single-event upset (SEU) modelling, and single-event upset hardening were performed. The effects of total-dose and proton environments on SEU responses are presented and quantified. Improved modelling and hardening techniques for SEU and GaAs and bipolar SRAMs are also presented. Techniques for SEU reduction in circuits, including a novel decoupling resistor structure, were evaluated. GRA

N92-15783# International Centre for Theoretical Physics, Trieste (Italy).
ULTRATHIN QUANTUM WELLS OF HgTe IN CdTe: INTERFACE STATES
A. Camacho, L. Quiroga, and F. J. Rodriguez (Universidad de Los Andes, Bogota, Columbia) Dec. 1990 19 p
(DE91-634185; IC-90/420) Avail: NTIS HC/MF A03

We present an exact calculation of the electronic structure of systems composed by a small number of HgTe layers into CdTe. Layer Green Functions are calculated from which interface state energies and density of states are obtained. We employ a realistic tight-binding method. Special attention is drawn to the anisotropic dispersion relation through the entire two-dimensional Brillouin zone for a monolayer of HgTe. Interface states depend sensitively on the valence-band-offset. A comparison is made with the single heterojunction case showing that the coupling between interfaces in the quantum well plays a minor role in determining the main features of such cases. DOE

N92-15784# International Centre for Theoretical Physics, Trieste (Italy).
INTERACTING-FERMION APPROXIMATION IN THE TWO-DIMENSIONAL ANNNI MODEL
M. D. Grynberg and H. Ceva (Comision Nacional de Energia Atomica, Buenos Aires, Argentina) Dec. 1990 12 p
(DE91-634188; IC-90/457) Avail: NTIS HC/MF A03

We investigate the effect of including domain-walls interactions in the two-dimensional axial next-nearest-neighbor Ising or ANNNI model. At low temperatures this problem is reduced to a one-dimensional system of interacting fermions which can be treated exactly. It is found that the critical boundaries of the low-temperature phases are in good agreement with those obtained using a free-fermion approximation. In contrast with the monotonic behavior derived from the free-fermion approach, the wall density or wave number displays reentrant phenomena when the ratio of the next-nearest-neighbor and nearest-neighbor interactions is greater than one-half. DOE

N92-15785# International Centre for Theoretical Physics, Trieste (Italy).
PHONON DISPERSION CURVES IN HIGH TEMPERATURE SOLIDS FROM LIQUID STRUCTURE FACTORS
M. Ferconi and M. P. Tosi Dec. 1990 10 p
(DE91-634189; IC-90/459) Avail: NTIS HC/MF A02

The density functional method is used to relate the phonon dispersion curves in a crystal near melting to the structure factor of its liquid near freezing. An illustration is given for potassium, by evaluation of the dispersion curves for all polarizations along

several symmetry directions in the Brillouin zone from measured liquid structure factors and comparison with neutron inelastic scattering data. The elastic limit in a monatomic crystal and the plasma frequency limit in the classical Wigner crystal are also briefly discussed. DOE

N92-15786# China Nuclear Information Centre, Beijing.
AN APPARATUS FOR MEASURING THE RESISTIVITY AND ZERO FIELD CURRENT DENSITY OF HIGH Tc SUPERCONDUCTING MATERIALS AT LN2 TEMPERATURE
Jianmin Liu, Qingju Shi, Xiaoling He, and Huanxing Li Dec. 1989 5 p In CHINESE; ENGLISH summary
(DE91-628644; CNIC-00368; SIP-0037) Avail: NTIS HC/MF A01

The principle and design of the measuring apparatus are introduced. The ranges of sensitivities of the apparatus are less than 10(exp -9) omega for resistivity of the superconducting materials and greater than 600 A for critical current. The accuracy of this apparatus is high due to taking the attenuation method under the LN2 temperature, the probe linearity is better than 1 percent, and the amplifier drift is about +/- 1 micro-V/h (equivalent to the input). The transformer can induce a current of about 1000 A in the superconducting ring. DOE

N92-15787# China Nuclear Information Centre, Beijing.
A NEW METHOD FOR STUDYING THE STRUCTURE RELAXATION OF AMORPHOUS MATTERS
Xiaowen Cao (Academia Sinica, Hefei, China) Nov. 1989 9 p In CHINESE; ENGLISH summary
(DE91-629486; CNIC-00366; ASIPP-0017) Avail: NTIS HC/MF A02

A new method for studying the structure relaxation of amorphous matters by Hall effect is proposed. The structure relaxation of the metal-type amorphous InSb has been experimentally studied. The experimental results show that this method is highly sensitive to the structure relaxation, and the mechanism of structure relaxation can be observed. DOE

N92-15788# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
NEUTRON DIFFRACTION STUDY OF THE MODULATED STRUCTURE OF Bi2(Sr,Ca)3Cu2O(8+GAMMA)
A. I. Beskrovnyj, M. Dlouha, Z. Jirak, and S. Vratislav 1989 16 p
(DE91-635013; JINR-E-14-89-795) Avail: NTIS HC/MF A03

The modulated structure of the 80 K superconductor Bi2(Sr,Ca)3Cu2O(8+gamma) is refined from the single-crystal neutron diffraction data on a monodomain block of dimensions 1.5 x 1.0 x 0.03 cu mm. The modulation is recognized as commensurate with period 4.75a, resulting in the superlattice 19a x b x c where (a = 5.397(1), b = 5.401(1), and c = 30.716(3) A) and the symmetry is Pnaa. The essential feature of the structure is the periodic insertion of additional oxygen rows into BiO planes, which in turn causes large modulation in all layers. The ideal oxygen stoichiometry is gamma = 4/19. Bonds in the BiO and SrO plane form characteristic chains running along the a-axis. The coordination of the Bi3(+) cations is uniform and consists of three mutually nearly perpendicular bonds to oxygens of 2.0-2.2 A lengths. The Sr2(+) cations are bonded only to eight oxygen atoms in maximum. About 7 percent of the Sr sites, located in the vicinity of the inserted oxygen, are possibly vacant. The Ca sites situated between the CuO2 planes are substituted to 30 percent by strontium. DOE

N92-15789# Academy of Sciences of the Ukrainian SSR, Kharkov. Inst. Problem Mashinostroeniya.
EXPERIMENTAL RESEARCH OF THE NbSe2-HYDROGEN SYSTEM
M. A. Obolenskij, Kh. B. Chashka, V. I. Beletskij, and A. V. Basteev 1989 48 p In RUSSIAN
(DE91-638208; IPMash-277) Avail: NTIS HC/MF A03

Results of low-temperature measurements of characteristics of the NbSe2-hydrogen system are presented. Some ideas about peculiarities of the hydrogen interaction with the typical representatives of the class of quasi-2D NbSe2 crystals are presented. Data on peculiarities of superconducting state, amplification of critical fields, currents, and temperature are given. A promising character of further studies is shown on the basis of the review of publication data and conducted measurements. DOE

N92-15790# Sandia National Labs., Albuquerque, NM.
STRAINED QUANTUM WELL InGaSb/AlGaSb HETEROSTRUCTURES GROWN BY MOLECULAR BEAM EPITAXY
J. F. Klem, J. A. Lott, J. E. Schirber, and S. R. Kurtz 1991 5 p Presented at the International Symposium on Gallium Arsenide and Related Compounds, Seattle, WA, 23-26 Sep. 1991
(Contract DE-AC04-76DP-00789)
(DE92-000997; SAND-91-0995C; CONF-9109208-4) Avail: NTIS HC/MF A01

Strained, modulation-doped InGaSb/AlGaSb quantum wells were grown on InP substrates by molecular beam epitaxy and characterized by magneto-transport measurements. Hole transport properties were strongly correlated with growth conditions. Shubnikov-de Haas measurements yielded a hole mass of (0.15 +/- 0.02) m(sub o), and hole mobilities as high as 3300 sq cm/Vs were obtained at 77K, with a density of 1.6 x 10(exp 12) cm(exp -2), thus showing promise for p-type field-effect transistor applications. DOE

N92-15791# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NEUTRON-PROTON MATRIX ELEMENT RATIOS OF 2(SUB 1)(SUP +) STATES IN (58, 60, 62, 64)Ni
R. Antalik 1989 10 p
(DE91-628747; JINR-E-4-89-719) Avail: NTIS HC/MF A02

The neutron-proton matrix element ratios (eta) for 2(sub 1)(sup +) states of even Ni isotopes are investigated within the framework of the shell model quasiparticle random-phase approximation. Special attention is devoted to the dependence of eta ratios on the radial neutron and proton ground-state density-distribution differences (delta(sup np)). This dependence is found to be about 0.5 delta(sup np). The theoretical eta ratios are 14-23 percent greater than the hydrodynamical limit. The theoretical delta(sup np) dependence of eta ratios enable us to understand the empirical eta ratio results. DOE

N92-15792# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
DETERMINATION OF MAGNETIC FIELD PENETRATION DEPTH IN SINGLE CRYSTALLINE SUPERCONDUCTING FILM YBa2Cu3O7 BY THE POLARIZED NEUTRON REFLECTION METHOD
S. V. Gaponov, E. B. Klyuenkov, and E. B. Dokukin et al 1989 3 p
(DE91-634219; JINR-R-3-89-1) Avail: NTIS HC/MF A01

The magnetic field penetration depth in a single crystalline superconducting film YBa2Cu3O7 (thickness 2000 A, deposited onto 1.0.0 plane of SrTiO3 single crystal) along c axis at T equals 5.2 K temperature, according to the thermal polarized neutron reflection experiments, is equal to Lambda sub c equals 970(sub -250)(exp +600) A. DOE

N92-15793# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
STUDY OF THE F2(+) CENTERS STABILIZATION PROCESS IN LiF:OH(-) CRYSTALS AND SPECTROSCOPY OF THE OH(-) DISSOCIATION M.S. Thesis
L. C. Courrol 1990 139 p In PORTUGUESE; ENGLISH summary
(DE91-640142; INIS-BR-2661) Avail: NTIS HC/MF A07

We studied the process of stabilization of the F2(+) centers in irradiated LiF:OH(-) single crystals. A consistent investigation of the wide number of defects produced by the radiation damage in the lattice allowed us to improve the experimental conditions to

increase the final number of stabilized F2(+). The model for the F2(+):O2(-) formation in LiF:OH(-) (irradiated) has been established based on a statistical distribution of the defects produced during the electron irradiation at 230 K. These stabilized centers are formed during the thermal diffusion of the anionic vacancies in competition with the isolated F2(+) centers. A critical distance of thirteen lattice parameters for a vacancy suggested that the O2(-) dipole is the precursor entity for the F2(+):O2(-) creation. A further increasing of the F2(+) stabilized concentration was created by the e(-) irradiation and the vacancy generation process by irradiating the samples at 77 K with a small dose of gamma rays. The same net effect was seen after the e(-) irradiation by keeping the samples at room temperature for at least 6 months as a consequence of the thermal activated diffusion of the remaining O2(-)-(alpha) dipoles and reaction with F centers. The sub-products of the OH(-) dissociation induced by the high energy irradiation were identified by spectroscopical analysis. A new defect was identified as a F(sub z) center containing a water molecule. Its luminescent properties and stability were determined. Future investigations and some implications of the model are discussed. DOE

N92-15794# Lawrence Livermore National Lab., CA.
EMISSION CROSS SECTIONS AND ENERGY EXTRACTION FOR THE MID-INFRARED TRANSITIONS OF Er, Tm, AND Ho IN OXIDE AND FLUORIDE CRYSTALS
L. L. Chase, S. A. Payne, L. K. Smith, W. L. Kway, and W. F. Krupke Apr. 1991 7 p Presented at the Advanced Solid-state Lasers Topical Meeting, Hilton Head, SC, 18-20 Mar. 1991
(Contract W-7405-eng-48)
(DE92-001888; UCRL-JC-105397; CONF-9103110-3) Avail: NTIS HC/MF A02

Emission cross sections have been measured for the transitions between the two lowest spin orbit multiplets of Er, Tm, and Ho in several fluoride and oxide crystals. Properties affecting energy extraction efficiency are summarized and pulsed extraction performance is calculated for several of these quasi-three-level laser media. DOE

N92-15795# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
CATHODOLUMINESCENCE OF DOPED COMPOUND SEMICONDUCTORS Ph.D. Thesis [KATHODOLUMINESZENZ DOTIERTER VERBINDUNGSHALBLEITER]
Barbara Kimpel 1991 78 p In GERMAN
(ETN-92-90591) Avail: NTIS HC/MF A05

The cathodoluminescence of II-VI and III-V compound semiconductors, which were doped with transition metal ions, was examined. An installation, to record correct decomposed spectra at deep temperature in the visible and in near infrared was built. Various doped compound semiconductors were examined at high electron jet excitation on nonlinearities. A series of GaAs:Cu and GaAs:Cr crystals were examined. Monoelectron models were proposed for the chromium and copper emissions using cathodoluminescence. GaAs crystals include an inherent defect, known as EL2, which is a double donor with energy levels of 0.8 and 1 eV under the conduction band. The presence of the EL2 defect in these crystals was taken into account for the discussion of the models. ESA

N92-15796# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.
INVESTIGATIONS OF CuInSe2 THIN FILMS AND CONTACTS
M. A. Nicolet (California Inst. of Tech., Pasadena.) Oct. 1991 12 p
(Contract DE-AC02-83CH-10093)
(DE91-002192; NREL/TP-214-4433) Avail: NTIS HC/MF A03

This report describes research into electrical contacts for copper indium diselenide (CuInSe2) polycrystalline thin films used for solar cell applications. Molybdenum contacts have historically been the most promising for heterojunction solar cells. This program studied contact stability by investigating thermally induced bilayer reactions between molybdenum and copper, indium, and selenium. Because selenization is widely used to fabricate CuInSe2 thin films for photovoltaic cells, a second part of the program investigated how the morphologies, phases, and reactions of pre-selenization Cu-In structures are affected by the deposition process and heat treatments. DOE

N92-15797# International Centre for Theoretical Physics, Trieste (Italy).
GENERALIZED ONE-DIMENSIONAL HUBBARD MODEL BEYOND NEAREST NEIGHBOUR APPROXIMATION
A. L. Kuzemsky and V. I. Inozemtsev (Joint Inst. for Nuclear Research, Moscow, USSR) Oct. 1990 16 p
(DE91-632419; IC-90/305) Avail: NTIS HC/MF A03

The one dimensional generalized Hubbard model which describes the system of nonrelativistic interacting fermions on the lattice was considered. The new approach to the problem of constructing of solvable nonrelativistic fermion systems on a lattice was proposed. This approach permits the consideration of the hopping term in Hamiltonian, which is not restricted to nearest neighbor sites. This so-called 'overjumped' model retains short range character of the standard Hubbard model also. The solutions in one- and two- particle sectors were obtained in an explicit form by using theory of Weierstrass elliptic functions. The obtained results give new insight into possibility of the construction of exactly solvable models of interacting fermions on a lattice. DOE

N92-15798# International Centre for Theoretical Physics, Trieste (Italy).
TRANSPORT MECHANISM IN BULK AMORPHOUS Ge20Se(80-x)Bi(x) SYSTEM
M. Arora, P. K. Bhatnagar, Swati, and P. C. Mathur (Delhi Univ., India) Oct. 1990 19 p
(DE91-633184; IC-90/365) Avail: NTIS HC/MF A03

Bismuth doping on bulk amorphous Ge20Se(80-x)Bi(x) system has been shown to produce drastic change in the electrical conductivity which has been found to be intrinsic in the entire range of measurement (80 to 300 K). Results of Thermoelectric Power (TEP) reveal a transition from p-type conduction for Bi (x=9 atomic percent). The important feature of TEP is its feeble temperature dependence as compared to conductivity (data) indication of thermally activated mobility. Out of various theoretical models the present data fits very well with two channel model proposed by Negel. The present analysis not only explains the discrepancies in the dc conductivity and TEP data but also provides the evidence for the existence of small tail of localized states at the band edges. DOE

N92-15799# International Centre for Theoretical Physics, Trieste (Italy).
THE SHIFTS IN THE GRAVITY CENTERS OF ENERGY LEVELS OF RARE EARTH IONS DUE TO CRYSTAL FIELD
Yimin Chen Dec. 1990 9 p
(DE91-641575; IC-90/464) Avail: NTIS HC/MF A02

The shifts in the gravity centers of energy levels of Er(exp 3+) in Y3Al5O12 caused by J-mixing are calculated. These shifts are as large as tens of cm(exp -1). We fit the levels with Racah parameters E(exp 1), E(exp 2), E(exp 3), and spin-orbital coupling constant (xi), and compare the results with and without taking into account these shifts. DOE

N92-15800# International Centre for Theoretical Physics, Trieste (Italy).
IONIC DIFFUSION IN SUPERIONIC-CONDUCTOR MELTS
K. Tankeshwar and M. P. Tosi Mar. 1991 16 p
(DE91-641594; IC-91/57) Avail: NTIS HC/MF A03

The self-diffusion coefficients D(sub +) and D(sub -) of the two ionic species in molten AgI, CuCl, CuBr and CuI are evaluated and contrasted with those calculated for molten NaCl. The evaluation adopts a simple model for liquid state dynamics, earlier proposed by Zwanzig to justify the Stokes-Einstein formula for monatomic fluids, and by suitable approximations relates the self-diffusion coefficients to pair potentials and to the pair structure of the melt. The results offer an interpretation for molecular dynamics data showing that, whereas for a normal system such

as NaCl the ratio D(sub +)/D(sub -) in the melt is of the order unity, a sizable difference between D(sub +) and D(sub -) persists in salts melting from a fast-cation conducting solid. This difference is explicitly related to liquid structure through differences in the structural backscattering of cations by cations and of halogens by halogens. The calculated magnitudes of D(sub +)/D(sub -) are quite satisfactory, while the absolute magnitudes of D(sub +) and D(sub -) are in good agreement with the data only for those salts (AgI, CuBr and NaCl) in which the masses of the two ionic species are not greatly different. DOE

N92-15801# International Centre for Theoretical Physics, Trieste (Italy).
SELF DIFFUSION IN ISOTOPIC FLUID
K. Tankeshwar Jan. 1991 14 p
(DE91-641603; IC-91/14) Avail: NTIS HC/MF A03

Expressions for the second and fourth frequency sum rules of the velocity auto-correlation function have been obtained for an isotopic fluid. These expressions and Mori memory function formalism have been used to study the influence of the particle mass and mole fraction on the self diffusion coefficient. Our results confirm the weak mass dependence of the self diffusion. The influence of the mole fraction of the light particles on the self diffusion constant has been found to increase for the larger particle mass. DOE

N92-15802# Sao Paulo Univ. (Brazil). Inst. de Fisica.
INTRODUCTION TO THE THEORY OF ELECTRON STATES IN SEMICONDUCTORS
M. J. Caldas 1990 52 p
(DE91-641604; IFUSP-P-858) Avail: NTIS HC/MF A04

These lectures were given at the 4th Brazilian School of Semiconductor Physics, and were directed at an audience of graduate students, some just starting research work, others almost at the end of doctorate programs, most of them involved with experimental research. I planned to present the theoretical side of research in semiconductors at an introductory level, preparing for the specialized lectures they would hear during the following week of the School. As such, I started from the Hartree-Fock and Local-Density approximations and worked through some of the basic descriptions of bulk crystalline semiconductors. I then gave a very brief view of the theory of defects in semiconductors, with emphasis on the interpretation of theoretical results, and on the comparability with experiment. DOE

N92-15803# Instituto de Fisica Teorica, Sao Paulo (Brazil).
HIGH-T(SUB c) BCS GAP-TO-T(SUB c) RATIO
V. C. Aguilera-Navarro and M. Llano 1991 10 p
(DE91-641748; IFT-P-009/91) Avail: NTIS HC/MF A02

Weak-coupling BCS superconductivity theory is shown to admit a more general T(sub c) formula allowing recent empirical values for both organic and ceramic superconductors of the gap-to-T (sub)c ratio larger than 3.53 not to be inconsistent with weak electron-boson coupling. DOE

N92-15804# Brookhaven National Lab., Upton, NY.
A BULK NIOBIUM SUPERCONDUCTING QUARTER WAVE RESONATOR
I. Ben-Zvi, E. Chiaveri, B. V. Elkonin, A. Facco, and J. S. Sokolowski (Istituto Nazionale di Fisica Nucleare, Padua, Italy) 1990 3 p
Presented at the EPAC 1990: 2nd European Particle Accelerator Conference ACROPOLIS, Nice (France), 11-16 Jun. 1990
(Contract DE-AC02-76CH-00016)
(DE92-002067; BNL-46700; CONF-900603-64) Avail: NTIS HC/MF A01

A bath-cooled all-niobium 160 MHz quarter wave resonator prototype was constructed and tested. The objective of this research has been the development of a high performance accelerating element with beta(sub opt) approximately = 0.11 for the ALPI linac at the Laboratori Nazionali di Legnaro. The design of this resonator was based upon a previous 150 MHz model, with minor changes due to the different frequency and to a modified welding procedure. An accelerating field of 5 MV/m was achieved at a power dissipation of 10 W and the low power Q was 2.4 x 10(exp 8). The resonator could dissipate 70 W of power without thermal breakdown. DOE

N92-15805# Manchester Univ. (England). Science and Technology Inst.
PROGRESS REPORT ON THE GROWTH OF ZnTe BY ATMOSPHERIC PRESSURE METAL-ORGANIC VAPOUR PHASE EPITAXY (APMOCVD) Annual Report, 15 Sep. 1989 - 14 Sep. 1990
J. O. Williams and A. Boumaza Oct. 1991 33 p
(Grant AF-AFOSR-0477-89)
(AD-A242426; EOARD-TR-91-12) Avail: NTIS HC/MF A03 CSCL 20/2

The growth temperature and the VI/II gas phase ratio have been optimized for ZnTe epitaxy on GaAs by APMOCVD. These are: a Tg = 430 C and a VI/II = 4. Material prepared under these conditions were found to be of high crystalline quality, comparable to the one obtained by MBE, and of high purity as demonstrated by the presence of the free exciton transition in low temperature PL spectra. Assuming the PL assignment is correct, the GaAs substrate and the organometallics are the main origins of layer contamination. Electrical properties are yet to be investigated and cannot be measured until reliable ohmic contacts can be made. The growth of ZnTe on GaSb substrates was not successful due to difficulties with pre-growth surface treatment of the substrate. A satisfying way of removing the oxide layer is being investigated. GRA

N92-15806# Rockwell International Corp., Thousand Oaks, CA. Science Center.
ELECTRODEPOSITION OF HIGH TEMPERATURE SUPERCONDUCTORS Quarterly Status Report No. 4, 1 Jul. - 30 Sep. 1991
D. M. Tench 18 Oct. 1991 5 p
(Contract N00014-90-C-0225)
(AD-A242439) Avail: NTIS HC/MF A01 CSCL 09/1

The overall objective of this project is to develop a process for direct electrodeposition of 'Yttrium Barium Copper' superconducting oxides from a molten salt at relatively low temperatures (300 to 550 C). The approach entails establishing a sequence of electrochemical steps for the layered deposition of yttrium, barium and copper oxide species from a eutectic sodium potassium nitrate melt. The background data needed to define appropriate procedures/voltage sequences for electrodeposition of Y-Ba-Cu HTSC oxides have been obtained. Electrodeposition of CuO has been investigated in detail and shown to be insensitive to temperature (at least to 400 C). All three metals have been demonstrated to electrodeposit from the nitrate melt and the current-voltage characteristics for the deposition/dissolution processes have been established. Both Cu and Y have been shown to electrodissolve in the melt and to deposit as the oxides (CuO and Y2O3). Deposition of Y oxide on Cu oxide electrodes results in a uniform film composition over a 0.4 micron thicknesses, indicating that formation of mixed metal oxide compounds occurs. Since direct oxide electrodeposition occurs (at least for Cu and Y) in the nitrate melt, this system is ideally suited for deposition of HTSC materials. GRA

N92-15807# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
MOLECULAR AND ELECTRONIC STRUCTURE OF THIN FILMS OF PROTOPORPHYRIN(IX)Fe(III)Cl Technical Report No. 1, period ending 1 Jan. 1991
Shelly R. Snyder and Henry S. White 10 Nov. 1991 46 p
(Contract N00014-91-J-1927)
(AD-A242443) Avail: NTIS HC/MF A03 CSCL 20/3

Electrochemical, scanning tunneling microscopy (STM), and tunneling spectroscopy studies of the molecular and electronic properties of thin films of protoporphyrin(IX)Fe(III)Cl (abbreviated as PP(IX)Fe(III)Cl) on highly oriented pyrolytic graphite (HOPG) electrodes are reported. PP(IX)Fe(III)Cl films are prepared by two different methods: (1) adsorption, yielding an electro-

chemically-active film, and (2) irreversible electrooxidative polymerization, yielding an electrochemically-inactive film. STM images, in conjunction with electro-chemical results, indicate that adsorption of PP(IX)Fe(III)Cl from aqueous solutions onto freshly cleaved HOPG results in a film comprised of molecular aggregates. In contrast, films prepared by irreversible electrooxidative polymerization of PP(IX)Fe(III)Cl have a denser, highly structured morphology, including what appear to be small pinholes (approx. 50A diameter) in an otherwise continuous film. GRA

N92-15808# State Univ. Coll. of New York, Buffalo. Dept. of Chemistry.
ORGANOGALLIUM COMPOUNDS CONTAINING THE NEOPHYL SUBSTITUENT. THE CRYSTAL AND MOLECULAR STRUCTURE OF TRANS-((Ph Me2CCH2)2GaN(H) (Pr))2
O. T. Beachley, Jr., M. J. Noble, Melvyn R. Churchill, and Charles H. Lake 11 Nov. 1991 30 p
(Contract N00014-90-J-1530)
(AD-A242589; SUNY/AB-TR-30) Avail: NTIS HC/MF A03 CSCL 07/3

The utilization of gallium in electronic materials including semiconductors and superconductors has led to a renewed interest in its chemistry. Even though a variety of organogallium compounds are known, relatively little is known about compounds which incorporate bulky organic substituents. Bulky substituents can lead to compounds with enhanced thermal stability as well as to compounds with unexpected structures. Consequently, our prior research involved investigations of the chemistry of gallium compounds with CH2SiMe3, 1CH2CMe3, 2,4,6-Me3-C6H2 and C5Me5 substituents, but only the mesityl derivative Ga(C6Me3H2)Cl2 displayed unusual chemistry. The compound Ga(C6Me3H2)Cl2 was characterized as a unique one dimensional polymer in which planar Ga(C6Me3H2)Cl units with distorted tetrahedral geometry were linked by bridging chloride ligands. The traditional structure of an organogallium dichloride is a chloride bridged dimer. GRA

N92-15809# Emory Univ., Atlanta, GA.
HREELS AND UPS STUDIES OF PH3 AND PD3 ON Si(110)
Jason C. Chu, Yue Bu, and M. C. Lin 1991 15 p
(Contract N00014-89-J-1235)
(AD-A242617; TR-6) Avail: NTIS HC/MF A03 CSCL 07/2

Various phosphorous compounds have been employed for semiconductor doping and chemical vapor deposition (CVD) of thin films such as InP. Phosphine (PH3), one of the smallest stable P-compounds, has been used most commonly as a CVD source molecule. Many studies have been made to elucidate the mechanisms of PH3 adsorption and decomposition on different metal surfaces, such as Rh, Rh/Al2O3, Ag, Pt, Ni and polycrystalline Fe under UHV conditions. Some experiments have also been conducted on silicon surfaces, including polycrystalline silicon. At low temperatures, PH3 may either molecularly adsorb or dissociatively adsorb on various surfaces, depending on the nature of surfaces. GRA

N92-15810# Advanced Fuel Research, Inc., East Hartford, CT.
EPITAXIAL GROWTH OF SINGLE CRYSTAL DIAMOND ON SILICON Project Status Report, 15 Aug. - 14 Sep. 1991
14 Sep. 1991 6 p
(Contract N00014-91-C-0101)
(AD-A242622; AFR-529012-4) Avail: NTIS HC/MF A02 CSCL 20/2

We have performed a series of depositions on Si(100) surfaces using the hot filament reactor. The depositions are fairly short in duration (75 minutes) so that the nucleation is observable. The deposition conditions are total pressure = 10 b sub = 1000 C, T sub filament-1850 deg C, and 1 percent C, and 1 percent CH4 and H2. The surfaces are prepared using various combinations of scratching, degreasing, and spin etching. The scratching preparation uses 6 diamond paste. Unscratched Si(100) has virtually no nucleation after 75 minutes of deposition. This is not surprising since other researchers find that 10-17 hours of CVD is required to cover fully the SiC buffer layer on unscratched Si. Future work will extend deposition times to 10 hours in the hot filament reactor and shorter times in the high growth torch reactor. By comparison, scratched Si(100) shows significant nucleation after 75 minutes of deposition. GRA

N92-15811# Florida Univ., Gainesville. Dept. of Electrical Engineering.
DEVELOPMENT OF ULTRA-LOW NOISE, HIGH SENSITIVITY PLANAR METAL GRATING COUPLED AlGaAs/GaAs MULTIQUANTUM WELL DETECTORS FOR FOCAL PLANE ARRAY (FPA) STARING IR SENSOR SYSTEMS Quarterly Progress Report No. 1, 1 Aug. - 31 Oct. 1991
Shen S. Li 1 Nov. 1991 21 p
(Contract N00014-91-J-1976)
(AD-A242821) Avail: NTIS HC/MF A03 CSCL 17/5

Since the beginning of this IR detector project, we have made significant progress toward achieving the original project goals. We have designed and fabricated two new types of IR detectors using step-bound-to-miniband (SBTM) and bound-to-miniband (BTM) transition multiple-quantum-well (MQW)/superlattice (SL) barrier structures grown by the molecular beam epitaxy (MBE) technique. The results showed that the dark current for the SBTM IR detector measured at 77 K was more than one order of magnitude lower than the conventional quantum well infrared photodetectors (QWIPs) (using bound-to-continuum band transition) reported in the literature. To optimize the grating couplers for the top and back illumination, we have designed and fabricated 10 new photomasks with various grating patterns and different grating periodicities to be used for the proposed study of light coupling efficiency versus grating periodicity in the large area MQW/SL IR detectors. GRA

N92-15812# Japan Atomic Energy Research Inst., Tokyo.
MECHANOCHEMICAL EFFECTS ON HIGH-T(SUB c) SUPERCONDUCTOR POWDERS
Taichi Yamada, Ryoji Nagai, Manabu Takeuchi (Ibaraki Univ., Mito, Japan), and Eisuke Minehara Mar. 1991 31 p In JAPANESE; ENGLISH summary
(DE91-508077; JAERI-M-91-029) Avail: NTIS HC/MF A03

We have investigated the mechanochemical effects on high-Tc superconductor YBa2Cu3O7-delta powders. The powder was mechanically ground in air using an agate mortar with a pestle. The grinding time was varied from 2 to 100 min. The mean particle sizes of the powders were measured by a sedimentation method. The degradation of superconductivity was evaluated by the measurements of the crystallinity and volume fraction of the superconducting phase. The crystallinity was estimated from X-ray diffraction patterns. The volume fraction of the superconducting phase was estimated from the diamagnetization. The results of these changes of 2 min. and 100 min. grinding are respectively as follows: (1) mean particle size: 10.8 microns and 7.2 microns; (2) crystallinity: 40.0 percent and 24.8 percent; (3) volume fraction of superconducting phase: 91.5 percent and 30.0 percent. Recovery of the crystallinity and superconductivity of the ground specimens by re-sintering and re-annealing was also studied. It was found that the recovery of both of the characteristics was not complete. DOE

N92-15813# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
MEASUREMENTS OF THE ELECTRIC FIELD GRADIENT AT CADMIUM IN YBa2Cu3O(x), Y2BaCuO5 AND Y2Cu2O5
H. Saitovitch and P. R. J. Silva 1990 14 p
(DE91-641747; CBPF-NF-018/90) Avail: NTIS HC/MF A03

The Electric Field Gradient (EFG) at diluted Cd(111) in YBa2Cu3O(x) was measured by Angular Correlation (AC). In order to determine the atom-probe localization, AC measurements were also, performed on Y2BaCuO5. A nuclear electric quadrupole interaction frequency (NQIF) was associated with Cd(111) in the YBa2Cu3O(x)Cu(1) site. DOE

N92-15814# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
A SIMPLE LOCALIZED-ITINERANT MODEL FOR PrAl3: CRYSTAL FIELD AND EXCHANGE EFFECTS
P. J. vonRanke and L. Palermo (Universidade Federal do Rio de Janeiro, Brazil) 1990 20 p
(DE91-642036; CBPF-NF-033/90) Avail: NTIS HC/MF A03

We present a simple magnetic model for PrAl3. The effects of crystal field are treated using a reduced set of levels and the corresponding wave functions are extracted from the actual crystal field levels of Pr(+3) in a hexagonal symmetry. The exchange between 4f- and conduction electrons are dealt within a molecular field approximation. An analytical magnetic state equation is derived and the magnetic behavior discussed. The parameters of the model are estimated from a fitting of the inverse susceptibility of PrAl3 given in the literature. DOE

N92-15815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AN OVERVIEW OF SILICON CARBIDE DEVICE TECHNOLOGY
Philip G. Neudeck (Ohio Aerospace Inst., Brook Park.) and Lawrence G. Matus 1992 9 p Presented at the Ninth Symposium on Space Nuclear Power Systems, Albuquerque, NM, 12-16 Jan. 1992; sponsored by New Mexico Univ.
(NASA-TM-105402; E-6803; NAS 1.15:105402) Avail: NTIS HC/MF A02 CSCL 20L

Recent progress in the development of silicon carbide (SiC) as a semiconductor is briefly reviewed. This material shows great promise towards providing electronic devices that can operate under the high-temperature, high-radiation, and/or high-power conditions where current semiconductor technologies fail. High quality single crystal wafers have become available, and techniques for growing high quality epilayers have been refined to the point where experimental SiC devices and circuits can be developed. The prototype diodes and transistors that have been produced to date show encouraging characteristics, but by the same token they also exhibit some device-related problems that are not unlike those faced in the early days of silicon technology development. Although these problems will not prevent the implementation of some useful circuits, the performance and operating regime of SiC electronics will be limited until these device-related issues are solved. Author

N92-15816# Melbourne Univ., Parkville (Australia). School of Physics.
DENDRITIC SURFACE MORPHOLOGY OF PALLADIUM HYDRIDE PRODUCED BY ELECTROLYTIC DEPOSITION
JuLin Peng and L. A. Bursill 1990 32 p
(DE91-632890; UM-P-90/94) Avail: NTIS HC/MF A03

Conventional and high-resolution electron microscopic studies of electrolytically-deposited palladium hydride reveal a fascinating variety of surface profile morphologies. The observations provide direct information concerning the surface structure of palladium electrodes and the mechanism of electrolytic deposition of palladium black. Both classical electrochemical mechanisms and recent modified diffusion-limited-aggregation computer simulations are discussed in comparison with the experimental results. DOE

N92-15817# Los Alamos National Lab., NM.
ELASTIC CONSTANTS AND THE STRUCTURAL PHASE TRANSITION IN La(2-x)Sr(x)CuO4
J. L. Sarrao, Ming Lei, A. Stekel, T. M. Bell, R. G. Leisure, L. J. Sham, W. M. Visscher, A. Migliori, and A. Bussmann-Holder 1991 11 p Presented at the 28th Annual Meeting of the Society of Engineering Science, Inc., Gainesville, FL, 6-8 Nov. 1991
(Contract W-7405-eng-36)
(DE92-002448; LA-UR-91-3141; CONF-911176-2) Avail: NTIS HC/MF A03

Resonant ultrasound spectroscopy is used to measure the temperature dependence of all six elastic moduli of La(2-x)Sr(x)CuO4. A giant softening (greater than 50 percent reduction) in the in-plane shear modulus, c(sub 66), is observed and is attributed to the tetragonal-orthorhombic structural phase transition in this material. This phase transition and the corresponding softening is examined with a simple anharmonic mechanical model and a macroscopic Ginsburg-Landau formalism exploiting the full symmetry of the crystal. DOE

N92-15818# Los Alamos National Lab., NM.
COMMENTS ON PHOTOELECTRON SPECTROSCOPY OF HIGH-(Tc)'S
A. J. Arko 1991 4 p Presented at the Conference on Fermiology of High T(sub c) Superconductors, Argonne, IL, 25-27 Mar. 1991
(Contract W-7405-eng-36)
(DE92-002452; LA-UR-91-3224; CONF-9103112-5) Avail: NTIS HC/MF A01

The photoemission discussion session during the Argonne conference on Fermiology of High-(Tc)'s provided a forum to air a number of unresolved issues in photoelectron spectroscopy that the following topics: (1) the exact energy dependence of the line width of the quasiparticle peaks; (2) chemical potential shifts with hole doping; (3) the lack of an observed superconducting gap in Y-123; and (4) reports of different results in the band structure of Bi-2212 from different groups. The first issue, while much discussed, essentially becomes a non-issue in the sense that nearly all theories predict a linear as well as a quadratic energy dependence to the quasiparticle lifetime. Furthermore, the data are not yet good enough to distinguish between linear and quadratic dependence in the important region within 0.1 eV of E(sub F). Regarding chemical potential shifts, they very definitely are observed with hole doping both in Y-123 and Bi-2212 in spite of the claims by RVB enthusiasts to the contrary. In Y-123, the shifts are as large as 0.75 eV. The non-observation of a gap in Y-123 is puzzling, but may be related to surface reconstruction and an overdoped situation. The important question of whether we have one or two bands near E(sub F) in Bi-2212 revolves around the surface quality of the samples studied by different groups. It is difficult to compare data taken at room temperature vs. data taken at low temperature when no documentation exists that a reconstruction did not occur. We suspect that the small second band championed by the Sendai group is a surface impurity band. DOE

N92-15881*# Lenoir-Rhyne Coll., Hickory, NC. Dept. of Physics and Earth Sciences.
THE MAGNITUDE OF THE MAGNETIC FIELD NEAR THE SURFACE OF A HIGH-T(SUB c) SUPERCONDUCTOR WITH A TRAPPED FLUX
Dan R. Overcash *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N92-15819# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE NATURE OF PHASE TRANSITION IN A TWO DIMENSIONAL PHI(EXP 4) THEORY
G. V. Efimov and G. Ganbold 1989 12 p
(DE91-628113; JINR-E-2-89-729) Avail: NTIS HC/MF A03

The vacuum stability of a scalar Phi(exp 4) theory in two dimensions is studied. A variational approach to estimate a functional integral defining the effective potential in this model is presented. It is found that the second-order phase transition takes place in the theory under consideration. This is in complete

agreement with the Simon-Griffiths theorem. It is shown that the loop approximation leads to a wrong critical behavior of the effective potential. DOE

N92-15820# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THE STRUCTURE OF CONSERVED CURRENTS IN THE THEORY OF GRAVITATION WITH THE BACKGROUND CONNECTION
M. N. Tentyukov 1989 11 p In RUSSIAN; ENGLISH summary
(DE91-636034; JINR-R-2-89-836) Avail: NTIS HC/MF A03

In the theory of gravitation with the background connection, the presence of the group of motions of the background connection leads to the existence of conserved Noether's currents. However, the structure of these currents is such that the conserved laws become improper and the group of the action invariance can be expanded to the infinitely parametrized pseudogroup. The construction of this expansion is investigated in detail. DOE

N92-15821# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
AN OPEN STRING IN A BACKGROUND NON-ABELIAN FIELD
B. M. Barbashov and A. L. Koshkarov 1989 8 p In RUSSIAN; ENGLISH summary
(DE91-636101; JINR-R-2-89-685) Avail: NTIS HC/MF A02

Interaction of charged strings with an external field is of interest in connection with the low-energy limit in the string field theory. Dynamics of a string with non-Abelian charges at ends in the Yang-Mills external field is considered. The action function is determined; the boundary-value problem and equation of motion for the string coordinates and isospin vector are deduced from the variational principle. Gauge conditions are proposed for this system, and a particular solution is discussed. DOE

N92-15822# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
N=1 SUPERSYMMETRIC FORMULATION OF THE FIELD THEORY WITH THE FUNDAMENTAL MASS
D. V. Fursaev 1989 10 p In RUSSIAN; ENGLISH summary
(DE91-636107; JINR-R-2-89-883) Avail: NTIS HC/MF A02

The N = 1 supercovariant formulation of the theory with the fundamental mass (FM) is proposed. All superfields are treated in the five-dimensional configurational space in which they satisfy the fundamental equation (FE). The Cauchy data for FE are field variables defined in the usual space-time. Their equations are derived as extremals of supercovariant functionals of action. It turns out that supercovariant functionals of action generalize the action of material and gauge fields which are specific of the theory with FM. DOE

N92-15823# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimentalnoj Fiziki.
CONFORMAL FIELD THEORY AND 2D CRITICAL PHENOMENA, PART 1
A. B. Zamolodchikov and Al. B. Zamolodchikov 1989 32 p
(DE91-625218; ITEP-112-89) Avail: NTIS HC/MF A03

Review of the recent developments in the 2-D conformal field theory and especially its applications to the physics of 2-D critical phenomena is given. It includes the Ising model, the Potts model, and minimal models corresponding to theories invariant under higher symmetries, such as superconformal theories, parafermionic theories, and theories with current and W-algebras. A non-Hamiltonian approach to 2-D field theory is formulated. DOE

N92-15824# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
ASHTEKAR FORMALISM WITH REAL VARIABLES
Wolfgang Kalau (Wuppertal Univ., Germany, F.R.) Dec. 1990 15 p Sponsored by Graduiertenfoerderung NRW
(NIKHEF-H/91-03; ETN-92-90446) Avail: NTIS HC/MF A03

A new approach to canonical gravity based on Ashtekar formalism is presented. In contrast to Ashtekar's variables, this formulation does not need complex quantities, nor does it lead to second class constraints. It is achieved by using a larger gauge group, SO(3,1), on account of which additional first class constraints which are cubic and quartic in the momenta are needed. ESA

N92-15825# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
RELATIVISTIC TIME DILATION IN AN EXTERNAL FIELD
J. W. vanHolten 25 Mar. 1991 16 p Sponsored by Stichting voor Fundamenteel Onderzoek der Materie
(NIKHEF-H/91-05; ETN-92-90447) Avail: NTIS HC/MF A03

It is shown that spinning particles in special relativity have non standard time transformation properties. Relativistic time dilation is demonstrated as a dynamical effect, which depends on interactions. As a result, even stationary particles may experience time dilation, for example in an external field. It happens, in particular, when there are extra degrees of freedom attached to a particle-like spin and a magnetic moment. This phenomenon is illustrated with quantum theory examples. ESA

N92-15826# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
QUANTUM MAXWELL THEORY ON ARBITRARY SURFACES
Matthias Blau and George Thompson (Mainz Univ., Germany, F.R.) May 1991 17 p Sponsored by Stichting voor Fundamenteel Onderzoek der Materie
(NIKHEF-H/91-08; MZ-TH/91-16; ETN-92-90450) Avail: NTIS HC/MF A03

Quantum Maxwell theory on two dimensional surfaces is studied. Using path integral methods, general and explicit expressions are derived for the partition function and correlation functions of intersecting and self intersecting loops on closed surfaces, and for the kernels on manifolds with boundaries. The role of large gauge transformations and topologically non trivial bundles is discussed. Results are compared with those of Yang Mills theory. ESA

N92-15827# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
QUANTUM YANG-MILLS THEORY ON ARBITRARY SURFACES
Matthias Blau and George Thompson (Mainz Univ., Germany, F.R.) May 1991 18 p Sponsored by Stiching voor Fundamenteel Onderzoekder Materie and BMFT, Bonn, Fed. Republic of Germany
(NIKHEF-H/91-09; MZ-TH/91-17; ETN-92-90451) Avail: NTIS HC/MF A03

Quantum Yang Mills theory is studied on two dimensional surfaces. Path integral methods are used to derive general and explicit expressions for the partition function, and expectation values of homologically trivial and nontrivial Wilson loops on closed surfaces of any genus, and for the kernels on manifolds with handles and boundaries. ESA

N92-15828# International Centre for Theoretical Physics, Trieste (Italy).
QUANTUM GRAVITATIONAL CORRECTIONS TO THE FUNCTIONAL SCHROEDINGER EQUATION
C. Kiefer (Zurich Univ., Switzerland) and T. P. Singh Oct. 1990 18 p
(DE91-625192; IC-90/312) Avail: NTIS HC/MF A03

We derive corrections to the Schroedinger equation which arise from the quantization of the gravitational field. This is achieved through an expansion of the full functional Wheeler-DeWitt equation with respect to powers of the Planck mass. We demonstrate that the correction terms are independent of the factor ordering which is chosen for the gravitational kinetic term. Although the corrections are numerically extremely tiny, we show how they lead, at least in principle, to shift in the spectral lines of hydrogen type atoms. We discuss the significance of these corrections for quantum field theory near the Planck scale. DOE

N92-15829# International Centre for Theoretical Physics, Trieste (Italy).
SU(SUB q)(1,1) AND THE RELATIVISTIC OSCILLATO R
R. M. Mir-Kasimov Nov. 1990 24 p
(DE91-632266; IC-90/383) Avail: NTIS HC/MF A03

It is shown that the generalization of the quantum harmonic oscillator to the case of the relativistic configurational space is a q-oscillator. The corresponding group of dynamical symmetry is the quantum group SU(sub q)(1,1). The deformation parameter being q=e(sup -omega/omega 0) where h omega 0 = 4mc squared and omega is a frequency of the oscillator. The deformation creation and annihilation operators are of finite difference. The corresponding deformation of the Heisenberg-Weyl group and new coherent states are also considered. DOE

N92-15830# International Centre for Theoretical Physics, Trieste (Italy).
MATRIX MODELS WITH (GAMMA(SUB)STRING)GREATER THAN O
C. Marzban and R. R. Viswanathan Dec. 1990 14 p
(DE91-632288; IC-90/415) Avail: NTIS HC/MF A03

Within the framework of c = 1 matrix models, we consider multi-matrix models. A connection is established between a D-dimensional gas of fermions (bosons) for odd (even) values of D. A statistical mechanical analysis yields the scaling law for the free energy, and hence the susceptibility exponents for the various models. The exponents turn out to be positive for the multi-matrix models, suggesting that these could represent models of 2 d-gravity coupled to c greater than 1 matter. Whereas in the c=1 case the density of states itself diverges as one approaches the critical point, in the D-matrix models various derivatives of the density of states diverge, with the order of the derivative depending on D. This qualitatively different behavior of the density of states could be a signal of the conjectured 'phase transition' at c=1. DOE

N92-15831# International Centre for Theoretical Physics, Trieste (Italy).
MATRIX ELEMENTS FOR MORSE OSCILLATORS: A LOCAL OPTIMIZED APPROACH
H. Kobeissi Oct. 1990 12 p
(DE91-632354; IC-90/302) Avail: NTIS HC/MF A03

Matrix elements M sub 4u4u' = (psi(sub 4u) absolute value of Q(r - r sub e) psi sub 4u') for Morse oscillators are considered. A 'local' approach to the determination of M sub 4u4u' suggests the form M sub 4u4u' = Sigma sub i I sub 4u4u'(i), where I sub 4u4u'(i) is proved to be of the form I sub 4u4u'(i) = Sigma sub n a sub n (r sub i+1 - r sub i) sup n, (i) being the interval (r sub i, r sub i+1), a sub n are simply related to the parameters of the Morse function, to 4u, 4u' and to the parameters of the functions Q. The intervals (i) are automatically determined by a 'local' error control; their number is shown to be limited (20 approx. 50 for practical cases). The method is applied to the case Q(r) = (r - r sub e) sup I, but also to Q(r) = (r - r sub e) sup I e sup m(r-r) sub e), and to any function Q expandable in (i) in power series. It can be used for high and low 4u, 4u' and I with equal ease. It can be used for the rotating Morse oscillator as well as for other potential functions under certain specified conditions. DOE

N92-15832# International Centre for Theoretical Physics, Trieste (Italy).
QUANTUM MECHANICAL EQUIVALENT OF THE RYDBERG QUANTIZATION RULE FOR DIATOMIC PROBLEMS
H. Kobeissi Oct. 1990 6 p
(DE91-632355; IC-90/335) Avail: NTIS HC/MF A02

The semiclassical Rydberg rule as used for the determination of the diatomic potential energy is considered, and a quantum mechanical equivalent of this rule is sought. The quantal rule is of the form Q(E;a) - Q(E;b) = 0, where E is a variable parameter, a and b are the limits of the internuclear distance r, Q(E;r) = -alpha(E;r)/beta(E;r), alpha and beta being the two 'canonical' functions well defined for a given potential U(r) and a given E. This 'quantal Rydberg rule' is independent of the wavefunction, yet it assures the conditions of continuity and at boundaries for the wavefunction. As the semiclassical rule does, the quantal rule allows the determination of the eigenvalues E sub 4u (and vibration-rotation eigenvalues E sub 4uj) when U is given, or that of U when E sub 4u and E sub 4uj are given. DOE

N92-15833# International Centre for Theoretical Physics, Trieste (Italy).
STATE VECTOR REDUCTION. PART 2: ELEMENTS OF PHYSICAL REALITY, NONLOCALITY AND STOCHASTICITY IN RELATIVISTIC DYNAMICAL REDUCTION MODELS
G. C. Ghirardi and P. Pearle (Hamilton Coll., Clinton, NY.) Feb. 1991 18 p
(DE91-641489; IC-91/23) Avail: NTIS HC/MF A03

The problem of getting a relativistic generalization of the CSL dynamical reduction model, which has been presented in part 1, is discussed. In so doing we have the opportunity to introduce the idea of a stochastically invariant theory. The theoretical model we present, that satisfies this kind of invariance requirement, offers us the possibility to reconsider, from a new point of view, some conceptually relevant issues such as nonlocality, the legitimacy of attributing elements of physical reality to physical systems and the problem of establishing causal relations between physical events. DOE

N92-15834# Instituto de Fisica Teorica, Sao Paulo (Brazil).
INCREASE OF INTERNAL ENERGY DUE TO MEASUREMENT
J. Daboul 1991 8 p
(DE91-641491; IFT-P-008/91) Avail: NTIS HC/MF A02

We argue that the internal energy, E = (H), of a macroscopic system in thermal equilibrium must increase if we measure an observable A which does not commute with the Hamiltonian, H. We derive an expression for calculating a lower bound for this increase in E. We then generalize the above result, and show that under certain conditions the expectation value (C) of an observable C should increase by the measurement of another observable A, if A and C do not commute. DOE

N92-15835# Instituto de Fisica Teorica, Sao Paulo (Brazil).
THE QUANTUM LIMIT FOR INFORMATION TRANSMISSION
M. Schiffer 1990 17 p
(DE91-641492; IFT-P-26/90) Avail: NTIS HC/MF A03

We give two independent and rigorous derivations for the quantum bound on the information transmission rate as proposed independently by Bekenstein and Bremermann, preceded by a heuristic argument showing why such a sort of bound should hold. In both approaches, information carriers are quanta of some field. The first method resembles the microcanonical approach to statistical mechanics where the strategy of overestimating the real number of states by relaxing the indistinguishability of quanta was adopted. The second is entirely based upon max-entropy methods. Amazingly enough, the results obtained by these physically unrelated premises turn out to be identical: the single (noiseless) channel capacity is I sub(max) E/2(pi)h bits/s. It is further shown that in a finite time no information can ever be conveyed unless the energy threshold 2(pi)h/tau is reached. DOE

N92-15836# Instituto de Fisica Teorica, Sao Paulo (Brazil).
SHANNON'S INFORMATION IS NOT ENTROPY
M. Schiffer 1990 10 p
(DE91-641493; IFT-P-27/90) Avail: NTIS HC/MF A02

We clear up the long-standing misidentification of Shannon's information with entropy. We show that information, in contrast to entropy, is not invariant under unitary transformations and that these quantities are only equivalent for representations consisting of Hamiltonian eigenstates. We illustrate this fact through a toy system consisting of a harmonic oscillator in a coherent state. It is further proven that the representations which maximize the information are those which are energy-eigenstates. This fact sets the entropy as an upper bound for Shannon's information. DOE

N92-15837# International Centre for Theoretical Physics, Trieste (Italy).
ANISOTROPIC SPHERES IN GENERAL RELATIVITY

H. Rago Jan. 1991 9 p Previously announced in IAA as A92-12266
(DE91-641504; IC-91/13) Avail: NTIS HC/MF A02

A prescription originally conceived for perfect fluids is extended to the case of anisotropic pressures. The method is used to obtain exact analytical solutions of the Einstein equations for spherically symmetric self-gravitating distribution of anisotropic matter. The solutions are matched to the Schwarzschild exterior metric. DOE

N92-15838# Instituto de Fisica Teorica, Sao Paulo (Brazil).
GLOBAL AND LOCAL TRANSFORMATIONS: AN OVERVIEW
R. Aldrovandi and J. G. Pereira 1990 28 p
(DE91-641505; IFT-P-28/90) Avail: NTIS HC/MF A03

Common aspects in gauge theories and general relativity are reviewed, with particular emphasis for the non-covariant behavior of the gauge field self-coupling and the gravitational field energy-momentum. They are quite similar provided and underlying flat space view of general relativity is adopted. DOE

N92-15839# Instituto de Fisica Teorica, Sao Paulo (Brazil).
THE ROLE OF EVENT HORIZONS IN QUANTUM GRAVITY
M. Schiffer 1990 15 p
(DE91-641506; IFT-P-38/90) Avail: NTIS HC/MF A03

We extend Bekenstein's result for the minimum variation of the black hole event horizon due to the absorption of an extended (classical) particle to the deSitter Universe. These classical equations are the bulk for the argument based on the correspondence principle: for large energies the classical and quantum results are in correspondence with each other. The outcome of this reasoning could not be more fruitful: it leads to the quantization of the event horizon area (either BH or cosmological) in units of Planck's length square. Consequences are discussed. DOE

N92-15840# International Centre for Theoretical Physics, Trieste (Italy).
THE CONSTRAINT OF NEWTON'S CONSTANT IN WORMHOLE
Xinzhou Li and Jianzu Zhang Jan. 1991 10 p
(DE91-641525; IC-91/12) Avail: NTIS HC/MF A02

The constraint of Newton's constant G(alpha) in wormhole is discussed which shows that G(alpha) assumes the maximum on the surface in the wormhole parameter alpha-space where the cosmological constant Lambda(alpha) = 0(+). This condition fixes the theta-parameter of QCD at theta = 0 which corresponds to strong CP conservation. DOE

N92-15841# International Centre for Theoretical Physics, Trieste (Italy).
STRING MODEL IN DIFFERENTIAL FORMS
S. N. Solodukhin Jan. 1991 14 p
(DE91-641527; IC-91/43) Avail: NTIS HC/MF A03

The string model in terms of the two-dimensional differential forms of arbitrary rank is formulated. The local supersymmetric string action with local conformal and Lorentz symmetries is constructed. The connection with topological quantum field theory is discussed. Covariant quantization of the model is investigated. The critical space-time dimension is found to be d=4. DOE

N92-15842# International Centre for Theoretical Physics, Trieste (Italy).
THE RELATION BETWEEN ANOMALOUS MAGNETIC MOMENT AND AXIAL ANOMALY
O. Teryaev Dec. 1990 6 p
(DE91-641759; IC-90/429) Avail: NTIS HC/MF A02

The conservation of total angular momentum of spinor particle leads to a simple relation between the famous Schwinger and Adler coefficients determining axial anomaly and anomalous magnetic moment, respectively. DOE

N92-15843# International Centre for Theoretical Physics, Trieste (Italy).
APPARENT CONSISTENCY OF RUTHERFORD'S HYPOTHESIS ON THE NEUTRON STRUCTURE VIA THE HADRONIC GENERALIZATION OF QUANTUM MECHANICS. 1: NONRELATIVISTIC TREATMENT
R. M. Santilli Mar. 1991 69 p
(DE91-641769; IC-91/47) Avail: NTIS HC/MF A04

Rutherford conceived the existence of the neutron back in 1920 as a 'compressed hydrogen atom', i.e., as an electron compressed (say, in the core of a star) inside the proton structure. While the existence of the neutron was subsequently confirmed, Rutherford's original conception of its structure was claimed to possess several 'inconsistencies', i.e., the lack of a quantitative representation of rest energy, meanlife, spin, etc. In this paper we show that these 'inconsistencies' appear to be due to the excessive approximations which are inherent in the use of the underlying discipline, ordinary quantum mechanics, for the physical conditions of Rutherford's structure. In fact, quantum mechanics can only provide a point-like abstraction of particles, and thus produce a model of Rutherford's neutron as a sort of small atomic structure, while the latter physical conditions imply the total mutual penetration of the wavepackets of the electron and of the proton one inside the other. It is shown that, if a generalization of quantum mechanics specifically conceived to represent the latter conditions (under the name of hadronic mechanics) is used to treat Rutherford's hypothesis, all 'inconsistencies' originating in the use of quantum mechanics appear to be resolved by permitting a consistent representation of all characteristics of the neutron, such as: rest energy, meanlife, size, spin, charge, space and charge parity, (anomalous) magnetic moment, as well as the neutron decay. It is therefore conjectured that Rutherford's compression of the hydrogen atom may well be the ultimate mechanism for the creation of neutrinos in nature. A reinspection of Barut's model on the neutron structure as a bound state of one proton, one electron and an antineutrino, is suggested for possible fundamental advances in the origin of the neutrino. DOE

N92-15844# Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study.
VARIOUS ACTIONS FOR PREGEOMETRY
Hidezumi Terazawa Apr. 1991 13 p
(DE91-508416; INS-869) Avail: NTIS HC/MF A03

Various actions for pregeometry are presented and compared. The 'space-field identity' which equates the n-beins to the derivatives of fundamental scalars is derived from a simple action but seems to be too restrictive to be practical. DOE

N92-15845# Moscow State Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki.
RENORMALIZATION IN P-ADIC QUANTUM FIELD THEORY
V. A. Smirnov 1990 11 p
(DE91-639753; INP-MSU-90-38-184; NIIYaF-MGU-90-38-184)
Avail: NTIS HC/MF A03

A version of p-adic perturbative Euclidean quantum field theory is presented. It is based on the new type of propagator which happens to be rather natural for p-adic space-time. Low-order Feynamn diagrams are explicity calculated and typical renormalization schemes are introduced: analytic, dimensional, and BPHZ renormalizations. The calculations show that in p-adic Feynman integrals only logarithmic divergences appear. DOE

N92-15846# Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil).
BIFURCATION OF THE SPIN-WAVE EQUATIONS
A. Cascon, J. Koiller, and S. M. Rezende (Universidade Federal de Pernambuco, Recife, Brazil) 1990 80 p
(DE91-641607; LNCC-041/90) Avail: NTIS HC/MF A05

We study the bifurcations of the spin-wave equations that describe the parametric pumping of collective modes in magnetic media. Mechanisms describing the following dynamical phenomena are proposed: (1) sequential excitation of modes via zero eigenvalue bifurcations; (2) Hopf bifurcations followed (or not) by Feingenbaum

cascades of period doubling; (3) local and global homoclinic phenomena. Two new organizing centers for routes to chaos are identified; in the classification given by Guckenheimer and Holmes, one is a codimension-two local bifurcation, with one pair of imaginary eigenvalues and a zero eigenvalue to which many dynamical consequences are known; secondly, global homoclinic bifurcations are associated with splitting of separatrices, in the limit where the system can be considered a Hamiltonian subjected to weak dissipation and forcing. We outline what further numerical and algebraic work is necessary for the detailed study following this program. DOE

N92-15847# Kyoto Univ., Uji (Japan). Inst. for Theoretical Physics.
UNIVERSALITY OF THE MATRIX MODEL APPROACH TO TWO-DIMENSIONAL QUANTUM GRAVITY
F. P. Zen Feb. 1991 13 p
(DE91-508170; YITP/U-91-16) Avail: NTIS HC/MF A03

Universality with respect to triangulations is investigated in the hermitian one-matrix model approach to 2-D quantum gravity for a potential containing both even and odd terms, V(phi) = 1/2phi(exp 2) + (g(sub 3)/3 sq. root of N)phi(exp 3) + (g(sub 4)/4N)(phi(sup 4)). With the use of analytical and numerical calculations, I find that the universality holds and the model describes pure gravity, which lead in the double scaling limit to coupled equations of Painleve type. DOE

N92-15848# Brookhaven National Lab., Upton, NY.
RADIATIVE CORRECTIONS AND NEW PHYSICS
W. J. Marciano Sep. 1991 7 p Presented at the Particles and Fields 1991, Vancouver (Canada), 18-22 Aug. 1991
(Contract DE-AC02-76CH-00016)
(DE92-002087; BNL-46637; CONF-910881-24) Avail: NTIS HC/MF A02

Several pursuits of 'New Physics' via precision measurements are surveyed. The inconsistency between tau lifetime-mass values and measured leptonic branching ratios is updated and a heavy fourth generation neutrino solution is described. Constraints on the Peskin-Takeushi S and T parameters are given. Consequences of low energy supersymmetry for grand unified theories are summarized. DOE

N92-15849# Florida State Univ., Tallahassee.
RESEARCH IN THEORETICAL PHYSICS
D. Robson and A. G. Williams 1991 11 p
(Contract DE-FG05-86ER-40273)
(DE92-002635; DOE/ER-40273/T1) Avail: NTIS HC/MF A03

This report discusses: hamiltonian lattice gauge theory; relativistic potential models; chiral potential models; covariant dynamical chiral symmetry breaking models of hadronic structure; light-cone calculations and models; and strangeness in the nucleon. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N92-15850*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
RESEARCH REPORTS: 1991 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM Final Report
Gerald R. Karr, ed., Charles R. Chappell, ed., Frank Six, ed., and L. Michael Freeman, ed. (Alabama Univ., Tuscaloosa.) Oct. 1991 253 p Fellowship program was held in Huntsville, AL, 3 Jun. - 9 Aug. 1991
(Grant NGT-01-008-021)
(NASA-CR-184253; NAS 1.26:184253) Avail: NTIS HC/MF A12 CSCL 05I

The basic objectives of the programs, which are in the 28th year of operation nationally, are: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of the participants' institutions; and (4) to contribute to the research objectives of the NASA Centers. The faculty fellows spent 10 weeks at MSFC engaged in a research project compatible with their interests and background and worked in collaboration with a NASA/MSFC colleague. This is a compilation of their research reports for summer 1991. For individual titles, see N92-15851 through N92-15902.

N92-15851*# Northrop Univ., Inglewood, CA. Dept. of Mechanical and Aeronautical Engineering.
HEAT SINK EFFECTS IN VARIABLE POLARITY PLASMA ARC WELDING **c37**
Amanie N. Abdelmessih *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 6 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 13H

The Space Shuttle External Tank is fabricated by the variable polarity plasma arc (VPPA) welding process. In VPPA welding, a noble gas, usually argon, is directed through an arc to emerge from the torch as a hot plasma jet. This jet is surrounded by a shielding gas, usually helium, to protect the weld from contamination with air. The high velocity, hot plasma jet completely penetrates the workpiece (resembling a line heat source) when operated in the 'keyhole' mode. The metal melts on touching the side of the jet, as the torch travels in the perpendicular direction to the direction of the jet, and melted metal moves around the plasma jet in the keyhole forming a puddle which solidifies behind the jet. Heat sink effects are observed when there are irregularities in the workpiece configuration, especially, if these irregularities are close to the weld bead. These heat sinks affect the geometry of the weld bead, i.e., in extreme cases they could cause defects such as incomplete fusion. Also, different fixtures seem to have varying heat sink effects. The objective of this research is to study the effect of irregularities in workpiece configuration and fixture differences (heat sink effects) on the weld bead geometry with the ultimate objective to compensate for the heat sink effects and achieve a perfect weld. Experiments were performed on different workpiece geometries and compared to approximate models. Author

N92-15852*# Alabama A & M Univ., Huntsville. Dept. of Mathematics.
OVERHAULING, UPDATING AND AUGMENTING NASA SPACELINK ELECTRONIC INFORMATION SYSTEM **c82**
Jean A. Blake *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 3 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05B

NASA/Spacelink is a collection of NASA information and educational materials stored on a computer at the MSFC. It is provided by the NASA Educational Affairs Division and is operated by the Education Branch of the Marshall Center Public Affairs Office. It is designed to communicate with a wide variety of computers and modems, especially those most commonly found in classrooms and homes. It was made available to the public in February, 1988. The system may be accessed by educators and the public over regular telephone lines. NASA/Spacelink is free except for the cost of long distance calls. Overhauling and updating Spacelink was done to refurbish NASA/Spacelink, a very valuable resource medium. Several new classroom activities and miscellaneous topics were edited and entered into Spacelink. One of the areas that received a major overhaul (under the guidance of Amos Crisp) was the SPINOFFS BENEFITS, the great benefits resulting from America's space explorations. The Spinoff Benefits include information on a variety of topics including agriculture, communication, the computer, consumer, energy, equipment and materials, food, health, home, industry, medicine, natural resources, public services, recreation, safety, sports, and transportation. In addition to the Space Program Spinoff Benefits, the following is a partial list of some of the material updated and introduced:

Astronaut Biographies, Miscellaneous Aeronautics Classroom Activities, Miscellaneous Astronomy Classroom Activities, Miscellaneous Rocketry Classroom Activities, Miscellaneous Classroom Activities, NASA and Its Center, NASA Areas of Research, NASA Patents, Licensing, NASA Technology Transfer, Pictures from Space Classroom Activities, Status of Current NASA Projects, Using Art to Teach Science, and Word Puzzles for Use in the Classroom. Author

N92-15853*# Niagra Univ., New York, NY. Dept. of Computer and Information Sciences.

DATA SIMULATION FOR THE LIGHTNING IMAGING SENSOR (LIS) **c61**

William L. Boeck *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

This project aims to build a data analysis system that will utilize existing video tape scenes of lightning as viewed from space. The resultant data will be used for the design and development of the Lightning Imaging Sensor (LIS) software and algorithm analysis. The desire for statistically significant metrics implies that a large data set needs to be analyzed. Before 1990 the quality and quantity of video was insufficient to build a usable data set. At this point in time, there is usable data from missions STS-34, STS-32, STS-31, STS-41, STS-37, and STS-39. During the summer of 1990, a manual analysis system was developed to demonstrate that the video analysis is feasible and to identify techniques to deduce information that was not directly available. Because the closed circuit television system used on the space shuttle was intended for documentary TV, the current value of the camera focal length and pointing orientation, which are needed for photoanalysis, are not included in the system data. A large effort was needed to discover ancillary data sources as well as develop indirect methods to estimate the necessary parameters. Any data system coping with full motion video faces an enormous bottleneck produced by the large data production rate and the need to move and store the digitized images. The manual system bypassed the video digitizing bottleneck by using a genlock to superimpose pixel coordinates on full motion video. Because the data set had to be obtained point by point by a human operating a computer mouse, the data output rate was small. The loan and subsequent acquisition of a Abekas digital frame store with a real time digitizer moved the bottleneck from data acquisition to a problem of data transfer and storage. The semi-automated analysis procedure was developed using existing equipment and is described. A fully automated system is described in the hope that the components may come on the market at reasonable prices in the next few years. Author

N92-15854*# Jackson State Univ., MS. Dept. of Technology.

END-EFFECTOR FOR ROBOTIC ASSEMBLY OF WELDED TRUSS STRUCTURES IN SPACE **c37**

William V. Brewer *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 13I

In June 1987, work was initiated at LaRC on end-effectors and preloaded joints for robotic truss assembly. This is part of an on-going research effort centered on a test facility that assembles 1 inch x 2 m identical struts into an 8 m diameter x 1.5 m deep platform truss. A detailed description of the test facility was published. The end-effector being used for the LaRC assembly demonstration is quite suitable for the Precision Segmented Reflector or other precision applications. These require high stiffness provided by mechanical joint preloads. Stiffness obtained in this manner is only required and provided over a load range far less than the ultimate strength of the strut tubes. Beyond this useful range, truss behavior is somewhat unpredictable. Mechanically preloaded joints of this type are less suitable for applications such as the Aero Brake where predictable strength and stiffness are required over a greater fraction of the load bearing capacity of component parts. Preliminary studies of the Aerobrake support truss indicate that struts of at least 3 different diameters and various lengths would improve performance. The double-ended end-effector currently in service is designed for only one diameter and length. Anticipated single-ended versions can accommodate varying lengths but not multiple diameters. Tradeoff considerations for welded joints relative to their mechanically preloaded counterparts are presented. Conclusions from this research are as follows: (1) repair by cut and re-weld on the original weld site should be research; (2) welded joints, though repairable, should not be used where high repair frequencies are anticipated; and (3) welded joints should be considered for an Aero Brake truss. Author

N92-15855*# Alabama Univ., Huntsville. Dept. of Computer Science.

DEVELOPMENT AND APPLICATION OF VIRTUAL REALITY FOR MAN/SYSTEMS INTEGRATION **c54**

Marcus Brown *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05H

While the graphical presentation of computer models signified a quantum leap over presentations limited to text and numbers, it still has the problem of presenting an interface barrier between the human user and the computer model. The user must learn a command language in order to orient themselves in the model. For example, to move left from the current viewpoint of the model, they might be required to type 'LEFT' at a keyboard. This command is fairly intuitive, but if the viewpoint moves far enough that there are no visual cues overlapping with the first view, the user does not know if the viewpoint has moved inches, feet, or miles to the left, or perhaps remained in the same position, but rotated to the left. Until the user becomes quite familiar with the interface language of the computer model presentation, they will be proned to lossing their bearings frequently. Even a highly skilled user will occasionally get lost in the model. A new approach to presenting type type of information is to directly interpret the user's body motions as the input language for determining what view to present. When the user's head turns 45 degrees to the left, the viewpoint should be rotated 45 degrees to the left. Since the head moves through several intermediate angles between the original view and the final one, several intermediate views should be presented, providing the user with a sense of continuity between the original view and the final one. Since the primary way a human physically interacts with their environment should monitor the movements of the user's hands and alter objects in the virtual model in a way consistent with the way an actual object would move when manipulated using the same hand movements. Since this approach to the man-computer interface closely models the same type of interface that humans have with the physical world, this type of interface is often called virtual reality, and the model is referred to as a virtual world. The task of this summer fellowship was to set up a virtual reality system at MSFC and begin applying it to some of the questions which concern scientists and engineers involved in space flight. A brief discussion of this work is presented. Author

N92-15856*# Mississippi State Univ., Mississippi State. Dept. of Industrial Engineering.

EVALUATION OF SCHEDULING TECHNIQUES FOR PAYLOAD ACTIVITY PLANNING **c81**

Stanley F. Bullington *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-088-021)
Avail: NTIS HC/MF A12 CSCL 05A

Two tasks related to payload activity planning and scheduling were performed. The first task involved making a comparison of space mission activity scheduling problems with production scheduling problems. The second task consisted of a statistical

analysis of the output of runs of the Experiment Scheduling Program (ESP). Details of the work which was performed on these two tasks are presented. Author

N92-15857*# Spelman Coll., Atlanta, GA. Dept. of Chemistry.
NONLINEAR OPTICAL PROPERTIES OF ORGANIC MATERIALS: A THEORETICAL STUDY **c74**
Beatriz H. Cardelino *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-088-021)
Avail: NTIS HC/MF A12 CSCL 20F

Replacement of electronic switching circuits in computing and telecommunication systems with purely optical devices offers the potential for extremely high throughput and compact information processing systems. The potential application of organic materials containing molecules with large nonresonant nonlinear effects in this area have triggered intensive research during the last decade. Interest on this area was due to two facts: (1) that many organic materials show nonlinearities that are orders of magnitude larger than those of conventional inorganic materials such as lithium niobate and potassium dihydrogen phosphate; and (2) that organic materials show much flexibility in terms of molecular designs. Some of the desirable characteristics that these materials should have are that they be transparent to the frequency of the incident laser and its second or third harmonic, that they have a high damage threshold, and, in the case of second-order effects, that their crystal structure or molecular orientation be accentric. Since polymeric assemblages can enhance the nonlinear response of organic molecules severalfold, efforts have been directed toward the synthesis of thin films with interpenetrating lattices of electroactive molecules. The goal of this theoretical investigation is to predict the magnitude of the molecular polarizabilities of organic molecules that could be incorporated into films. These calculations are intended to become a powerful tool to assist material scientists in screening for the best candidates for optical applications. The procedure that was developed for the present calculations is based on the static-field approach, and is a modification to the method developed by Dewar and Stewart, 1984 for calculating molecular linear polarizabilities. Author

N92-15858*# Alabama Univ., Huntsville. Dept. of Mathematical Sciences.
A MINIMUM PROPELLANT SOLUTION TO AN ORBIT-TO-ORBIT TRANSFER USING A LOW THRUST PROPULSION SYSTEM **c13**
Shannon S. Cobb *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 22A

The Space Exploration Initiative is considering the use of low thrust (nuclear electric, solar electric) and intermediate thrust (nuclear thermal) propulsion systems for transfer to Mars and back. Due to the duration of such a mission, a low thrust minimum-fuel solution is of interest; a savings of fuel can be substantial if the propulsion system is allowed to be turned off and back on. This switching of the propulsion system helps distinguish the minimal-fuel problem from the well-known minimum-time problem. Optimal orbit transfers are also of interest to the development of a guidance system for orbital maneuvering vehicles which will be needed, for example, to deliver cargoes to the Space Station Freedom. The problem of optimizing trajectories for an orbit-to-orbit transfer with minimum-fuel expenditure using a low thrust propulsion system is addressed. Author

N92-15859*# Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Mechanical Engineering.
AN ASSESSMENT OF SECONDARY LOSS REDUCTION TECHNIQUES FOR STME LOX TURBINE **c20**
Mingking K. Chyu *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

One of the primary objectives of the National Launch System (NLS) program, explored jointly by NASA and several other government agencies, is to develop a new Space Transportation Main Engine (STME) which will perform better and is more reliable than the present Space Shuttle Main Engine (SSME). Preliminary design of the Oxidizer (LOX) turbine in STME has recently been completed by Pratt and Whitney (P&W). It is a single-stage, high impulsive turbine with an approximately 170-degree deflection angle across the rotor. Due mainly to strong flow turning, the secondary loss in the rotor passage accounts for nearly 50 percent of the total loss over the entire stage, based on a mean-line prediction reported by P&W. To reduce such a significant loss with an aim to further improve STME, performance has recently become one of the major research tasks for the Consortium Turbine Team at MSFC. As part of this team effort, the primary objective of the study is to identify and examine prospective approaches for secondary loss reduction. Relevant information reported earlier in the open literature, primarily for jet-engine applications, was also reviewed to a great extent. It is hoped that information gained from this study will promote further understanding toward these approaches and their potential applicability in STME turbines. Author

N92-15860*# State Univ. of New York, Utica. Structures and Dynamics Lab.
AN OVERVIEW OF THE CURRENT TECHNOLOGY RELEVANT TO THE DESIGN AND DEVELOPMENT OF THE SPACE TRANSPORTATION MAIN ENGINE (STME) **c20**
Digendra K. Das *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

The objective of this project was to review the latest literature relevant to the Space Transportation Main Engine (STME). The search was focused on the following engine components: (1) gas generator; (2) hydrostatic/fluid bearings; (3) seals/clearances; (4) heat exchanges; (5) nozzles; (6) nozzle/main combustion chamber joint; (7) main injector face plate; and (8) rocket engine. Author

N92-15861*# Alabama Univ., Huntsville.
EXPERIMENTAL INVESTIGATION OF A SOLID ROCKET COMBUSTION SIMULATOR **c20**
Robert A. Frederick, Jr. *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

The response of solid rocket motor materials to high-temperature corrosive gases is usually accomplished by testing the materials in a subscale solid rocket motor. While this imposes the proper thermal and chemical environment, a solid rocket motor does not provide practical features that would enhance systematic evaluations such as: the ability to throttle for margin testing, on/off capability, low test cost, and a low-hazards test article. Solid Rocket Combustion Simulators (SRCS) are being evaluated by NASA to test solid rocket nozzle materials and incorporate these essential practical features into the testing of rocket materials. The SRCS is designed to generate the thermochemical environment of a solid rocket. It uses hybrid rocket motor technology in which gaseous oxygen (Gox) is injected into a chamber containing a solid fuel grain. Specific chemicals are injected in the aft mixing chamber so that the gases entering the test section match the temperature and a non-dimensional erosion factor B' to insure similarity with a solid motor. Because the oxygen flow can be controlled, this approach allows margin testing, the ability to throttle, and an on/off capability. The fuel grains are inert which makes the test article very safe to handle. The objective of this work was to establish the baseline operating characteristics of a Labscale Solid Rocket Combustion Simulator (LSRCS). This included

establishing the baseline burning rates of plexiglass fuels and the evaluation of a combustion instability for hydroxy-terminated polybutadyene (HTPB) propellants. The scope of the project included: (1) activation of MSFC Labscale Hybrid Combustion Simulator; (2) testing of plexiglass fuel at Gox ranges from 0.025 to 0.200 lb/s; (3) burning HTPB fuels at a Gox rate of 0.200 lb/s using four different mixing chamber configurations; and (4) evaluating the fuel regression and chamber pressure responses of each firing. Author

N92-15862*# Alabama Univ., Tuscaloosa. Dept. of Engineering Mechanics.

USE OF PHOTOSTRESS TECHNIQUES TO CHARACTERIZE THE MECHANICAL BEHAVIOR OF WELDMENTS **c39**

Samuel C. Gambrell, Jr. *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20K

Photoelastic coatings are useful to view strains in a large field and to examine strain gradients in the field. Contrary to strain gages which average strains along their length, photoelastic coatings provide measurements of strain over a gage length of essentially zero (at a point). When testing is done using specimens having welds between parent material, there are, in general, four zones in which strains may be significantly different. These zones are: (1) the weld material; (2) the fusion boundary; (3) the heat affected zone; and (4) the parent material. To date, most all strain measurement on welded specimens has been done using strain gages to measure in the various zones, thereby averaging across the strain gradient and across zone boundaries in some cases. In an effort to eliminate strain averaging, photoelastic coatings were used to characterize the mechanical behavior of weldments when tested in uniaxial tension. Data were taken at various points along the specimen and were used to construct stress-strain curves. Author

N92-15863*# University of Southern Mississippi, Hattiesburg. Dept. of Management Information Systems.

RECOMMENDATIONS FOR AN EXECUTIVE INFORMATION SYSTEM (EIS) FOR THE NASA ACCOUNTING AND FINANCIAL INFORMATION SYSTEM (NAFIS) **c82**

Ernest Preston Goss *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 3 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05B

The objectives were to: (1) survey state-of-the-art computing architectures, tools, and technologies for implementing an Executive Information System (EIS); (2) review MSFC capabilities and efforts in developing an EIS for Shuttle Projects Office and the Payloads Project Office; (3) review management reporting requirements for the NASA Accounting and Financial Information System (NAFIS) Project in the areas of cost, schedule, and technical performance, and insure that the EIS fully supports these requirements; and (4) develop and implement a pilot concept for a NAFIS EIS. A summary of the findings of this work is presented. Author

N92-15864*# Tennessee Technological Univ., Cookeville. Dept. of Mechanical Engineering.

IGNITION TRANSIENT ANALYSIS OF SOLID ROCKET MOTOR **c20**

Samuel S. Han *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

Measurement data on the performance of Space Shuttle Solid Rocket Motor show wide variations in the head-end pressure changes and the total thrust build-up during the ignition transient periods. To analyze the flow and thermal behavior in the tested solid rocket motors, a 1-dimensional, ideal gas flow model via the SIMPLE algorithm was developed. Numerical results showed that burning patterns in the star-shaped head-end segment of the propellant and the erosive burning rate are two important factors controlling the ignition transients. The objective of this study is to extend the model to include the effects of aluminum particle commonly used in solid propellants. To treat the effects of aluminum-oxide particles in the combustion gas, conservation of mass, momentum, and energy equations for the particles are added in the numerical formulation and integrated by an inter-phase-slip algorithm. Author

N92-15865*# Alabama A & M Univ., Huntsville. Dept. of Chemistry.

FAILURE ANALYSIS OF THE LITHIUM BATTERY: A STUDY OF THE HEADER DEPOSIT ON THE CELL TOP AND DIFFUSION WITHIN THE ELECTRODE GLASS SEAL USING NUCLEAR MICROANALYSIS AND FFTIR SPECTROSCOPY **c33**

Razi A. Hassan *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 10C

The Solid Rocket Booster Range Safety System (SRBRSS) uses a lithium/poly-carbon monofluoride primary battery as a source of electrical power. After cell fabrication and activation, some battery cells have shown self discharge. One possible source of this cell discharge has been suggested to be the formation and growth of a conducting crystallized chemical compound across the glass bead insulator, electrically shorting the glass bead to the casing. This laboratory has begun an analysis of this compound, the glass seal holding the cathode into place, and the cell electrolyte, using Fast Fourier Transform Infrared (FFTIR) Analysis, Rutherford Backscattering Spectroscopy (RBS), and Nuclear Reaction Microanalysis. Preliminary measurements have confirmed the existence of lithium, nitrogen, fluorine, and oxygen on a reddish-brown deposit covering parts of the glass seal holding the positive electrode in place. Cells using Li metal electrodes, have many advantages over conventional primary batteries. One principal disadvantage of using Li batteries on a commercial basis would be the environmental impact of the fluorocarbon material. Another would be the relatively high expense of (CF)n. Author

N92-15866*# Cincinnati Univ., OH. Dept. of Electrical and Computer Engineering.

ON THE DEVELOPMENT OF SYSTEM-THEORETIC TOOLS FOR THE DESIGN OF INTEGRATED HEALTH MONITORING AND CONTROLS FOR ROCKET PROPULSION SYSTEMS **c20**

Arthur J. Helmicki *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

As NASA continues to develop various advanced propulsion technologies for space exploration, two factors are becoming increasingly dominant in design specifications: increase operational reliability and decrease operational cost. One approach that has been proposed to meet these challenges is to incorporate into current and future rocket propulsion systems some sort of diagnostic/monitoring capability in the form of a Health Monitoring System (HMS). HMS technology offers the promise of increased operational reliability through its ability to assess system performance, detect and isolate degradations and/or failures, and modify system operation so as to minimize negative effects on performance. The purpose of this research is to study, from a systems engineering perspective, the particular issues of analysis and synthesis for generic HMS's. Author

N92-15867*# Auburn Univ., AL. Dept. of Electrical Engineering.

NUMERICAL METHODS FOR THE ANALYSIS OF SAMPLED-DATA SYSTEMS AND FOR THE COMPUTATION OF SYSTEM ZEROS **c61**

A. Scottedward Hodel *In* Alabama Univ., Research Reports:

1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
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MARSYAS is a computer aided control system design package for the simulation and analysis of open loop and closed loop dynamic systems. Outlined here is the numerical and theoretical basis of the MARSYAS functions developed during the summer of 1991. In particular, the numerical computation of the matrix exponential e(exp A) = I + A + A(exp 2)/2! + A(exp 3)/3! + ... and the numerical computation of the finite system zeros of a dynamic system (continuous time or discrete time) are presented. Author

N92-15868*# Alabama A & M Univ., Huntsville. Food Science and Animal Industries.
BIOLOGICAL PATTERNS: NOVEL INDICATORS FOR PHARMACOLOGICAL ASSAYS **c52**
Jacqueline U. Johnson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 3 p (For primary document see N92-15850 06-80)
(Grant NGT-01-002-099)
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Variable gravity testing using the KC-135 demonstrated clearly that biological pattern formation was definitely shown to result from gravity alone, and not from oxygen gradients in solution. Motile pattern formation of spermatozoa are driven by alternate mechanisms, and apparently not affected by short-term changes in gravity. The chemical effects found appear to be secondary to the primary effect of gravity. Cryopreservation may be the remedy to the problem of 'spare' or 'standing order' biological samples for testing of space lab investigations, but further studies are necessary. Author

N92-15869*# Alabama A & M Univ., Huntsville. Dept. of Physics.
DISORDERING AND H-EMBRITTLEMENT OF Pb(110) SURFACE USING EMBEDDED ATOM METHOD AND MOLECULAR DYNAMICS **c26**
Majid Karimi *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11F

The dynamics and structure of the crystal melt interface are of great importance in crystal growth, melting, and other properties of the solid-liquid interface. The Embedded Atom Method (EAM), a semiempirical method developed by Daw and Baskes for determining the energetics of atoms in a bulk environment, is a useful method in the computer simulation. The EAM functions of PB in conjunction with the MD code are employed to study melting and disordering of the Pb(100) surface. The EAM functions are fitted to the bulk experimental data at zero temperature, and it is not clear if it will behave correctly at higher temperatures. In fact, it is shown that use of a similar type of potential at higher temperatures might result in a negative coefficient of thermal expansion. The primary purpose here is to perform MD simulation combined with the EAM functions of PB to study melting of the Pb(100) surface. This provides an accurate test of the EAM functions at higher temperatures. In particular, we calculate the two dimensional structure factor, the two dimensional distribution function, and density profile as a function of temperature up to the melting point of lead. Author

N92-15870*# City Univ. of New York, Bronx. Dept. of Engineering Technologies.
DEVELOPMENT OF A CALIBRATED SOFTWARE RELIABILITY MODEL FOR FLIGHT AND SUPPORTING GROUND SOFTWARE FOR AVIONIC SYSTEMS **c61**
Stella Lawrence *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

The object of this project was to develop and calibrate quantitative models for predicting the quality of software. Reliable flight and supporting ground software is a highly important factor in the successful operation of the space shuttle program. The models used in the present study consisted of SMERFS (Statistical Modeling and Estimation of Reliability Functions for Software). There are ten models in SMERFS. For a first run, the results obtained in modeling the cumulative number of failures versus execution time showed fairly good results for our data. Plots of cumulative software failures versus calendar weeks were made and the model results were compared with the historical data on the same graph. If the model agrees with actual historical behavior for a set of data then there is confidence in future predictions for this data. Considering the quality of the data, the models have given some significant results, even at this early stage. With better care in data collection, data analysis, recording of the fixing of failures and CPU execution times, the models should prove extremely helpful in making predictions regarding the future pattern of failures, including an estimate of the number of errors remaining in the software and the additional testing time required for the software quality to reach acceptable levels. It appears that there is no one 'best' model for all cases. It is for this reason that the aim of this project was to test several models. One of the recommendations resulting from this study is that great care must be taken in the collection of data. When using a model, the data should satisfy the model assumptions. Author

N92-15871*# Florida Univ., Gainesville. Dept. of Astronomy.
DEVELOPMENT OF A MOON-BASED MAGNETOSPHERIC AND CORONAL IMAGER USING A LARGE BROADBAND ARRAY **c89**
George Lebo *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 03A

The 'Missions to and from Planet Earth' mandated by President Bush in 1989 provide a unique opportunity for magnetospheric and coronal plasma physicists to cooperate with low frequency radio astronomers in the development of an advanced experiment designed for the lunar surface. A large active lunar based array would sound the Earth's magnetosphere at VLF frequencies and the solar corona at decametric wavelengths allowing plasma physicists to map both the Earth's magnetosphere and those regions in the solar corona that trigger precursors to solar flares. With the transmitter silent, the array would become the ideal low frequency radio telescope, examining both geospace emissions such as auroral kilometric radiation and extraterrestrial signals from the planets, pulsars, supernova remnants, and active galactic nuclei. Both experiments satisfy requirements mandated in both 'Mission to Planet Earth' and in 'Mission from Planet Earth.' By proposing a cooperative effort both communities (plasma physicists and radio astronomers) stand to benefit. Jim Green, Director of the NASA Space Science Data Center (NSSDC) at GSFC; Tony Phillips, Research Fellow at California Institute of Technology; T. D. Carr, Director of the University of Florida Radio Observatory (UFRO) and the author are enlisting the cooperation of the scientific community in defining the system specifications. Some components, such as the receivers, will be standard 'off-the-shelf' items, and hence will require little developmental research. However, the individual antenna elements and the phasing and matching networks will require some R&D to satisfy the frequency requirements (20 KHz-40 MHz). By flying the experiment in Earth orbit first, Dr. Green proposes to gather valuable magnetospheric data as well as to prove the principle of the large moon based experiment. He claims that funding for the preliminary ground based studies at the UFRO may be available as early as FY-92. Author

N92-15872*# Alabama Univ., Huntsville. Dept. of Electrical Engineering.

ADAPTIVE OPTICS IN COHERENT LIDAR WIND MEASUREMENTS: A FEASIBILITY STUDY **c47**

Robert P. Leland *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 04B

Laser Doppler radar (lidar) is widely used for remote sensing of wind velocities. Usable wavelengths for the laser are limited by the effects of atmospheric turbulence. An adaptive optical system is proposed to compensate for turbulence effects on signal power. The feasibility of an adaptive system is considered in light of the effects of speckle from the aerosol target. It is concluded that adaptive optics is a promising technique for improving the performance of a 2 micron lidar wind measurement system. The chief technical challenges are a laser that will give the required output and pulse repetition rate, a combined Hartmann sensor and heterodyne detector, and a suitable reconstruction algorithm.
Author

N92-15873*# Mississippi State Univ., Mississippi State. Dept. of Physics and Astronomy.

THE BATSE SLED: THE PROBLEM AND THE CORRECTION **c32**

John Patrick Lestrade *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20N

The Burst And Transient Source Experiment (BATSE) has been in space for 4 months and, by anyone's reckoning, is performing better than even the most optimistic pre-flight predictions. That doesn't mean there haven't been some small surprises. Because of the discreteness of gamma-ray energies available to us in pre-flight testing, we could not subject the instrument to the continuous distribution of energies it now sees in space. Therefore, it was not until the beginning of mission operations that a small non-linearity was discovered in the low energy region of the SPD spectra. The nickname for this depression is the SLED (Spectroscopy Low-Energy Depression). Sample spectra for module 6 at two gains (1X and 0.4X) are given. Note that the position of the sled is gain-independent in channel space. A further study on a non-flight module discovered the cause lay in the spectroscopy analog electronics. Above a certain energy threshold, the digital signal from the SPEC-FAST2 discriminator causes, in effect, an extra small amount of charge to be added to the SHER analog input. The laboratory measurements of SHER output energy as a function of input energy are presented. The change of slope at the point of the SLED results in narrower bin widths for the channels in that region. The SLED is approximately 5 channels wide. It should be mentioned that below the SLED and for many decades above the SLED the response is extremely linear. The proposed fix was to move the lower straight line up to match the extrapolation of the upper straight line, shown by the dotted line. In effect, this means reassigning channel numbers. All channel edges lower than the SLED are moved a fixed amount to higher channel numbers. Channel edges in the SLED are moved a different amount depending on their position. The latter obviously results in narrower channel widths in energy space.
Author

N92-15874*# Oakwood Coll., Huntsville, AL. Dept. of Biological Sciences.

VISUALIZATION OF DNA MOLECULES IN TIME DURING ELECTROPHORESIS **c72**

Seth Lubega *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
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For several years individual DNA molecules have been observed and photographed during agarose gel electrophoresis. The DNA molecule is clearly the largest molecule known. Nevertheless, the largest molecule is still too small to be seen using a microscope. A technique developed by Morikawa and Yanagida has made it possible to visualize individual DNA molecules. When these long molecules are labeled with appropriate fluorescence dyes and observed under a fluorescence microscope, although it is not possible to directly visualize the local ultrastructure of the molecules, yet because they are long light emitting chains, their microscopic dynamical behavior can be observed. This visualization works in the same principle that enables one to observe a star through a telescope because it emits light against a dark background. The dynamics of individual DNA molecules migrating through agarose matrix during electrophoresis have been described by Smith et al. (1989), Schwartz and Koval (1989), and Bustamante et al. (1990). DNA molecules during agarose gel electrophoresis advance lengthwise thorough the gel in an extended configuration. They display an extension-contraction motion and tend to bunch up in their leading ends as the 'heads' find new pores through the gel. From time to time they get hooked on obstacles in the gel to form U-shaped configurations before they resume their linear configuration.
Author

N92-15875*# Puerto Rico Univ., Rio Piedras. Dept. of Civil Engineering.

EFFECTS OF VEGETATION ON SOIL MOISTURE DISTRIBUTION AND FLUX WITH IMPLICATIONS FOR THE GLOBAL HYDROLOGIC CYCLE **c43**

Emir Jose Macari *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 08H

Recent climate modeling experiments have identified the critical need for a better understanding of land surface - atmosphere interactions. An important issue in global climate modeling is to be able to relate land surface and atmospheric processes. In the past this link has been inadequately represented due to the lack of understanding of the interaction between the processes and also due to the large spatial variability of the hydrological and soil properties. A project was initiated at the Marshall Space Flight Center (MSFC) in FY-90 under the Center's Directorate Discretionary Fund (CDDF) to study small-scale effects of vegetation on the distribution and fluxes of soil moisture. Installation of a large array of instruments was accomplished during that first year (FY-90). During this second year of the project, the instrumentation and data collection systems were improved and data has begun to be taken. Preliminary analysis of the data show that the equipment has been functioning properly. Some of the preliminary results that have recently been analyzed are given.
Author

N92-15876*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.

CONTROL OF A FLEXIBLE BEAM USING FUZZY LOGIC **c63**

Claire L. McCullough *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

The goal of this project, funded under the NASA Summer Faculty Fellowship program, was to evaluate control methods utilizing fuzzy logic for applicability to control of flexible structures. This was done by applying these methods to control of the Control Structures Interaction Suitcase Demonstrator developed at Marshall Space Flight Center. The CSI Suitcase Demonstrator is a flexible beam, mounted at one end with springs and bearing, and with a single actuator capable of rotating the beam about a pin at the fixed end. The control objective is to return the tip of the free end to a zero error position (from a nonzero initial condition). It is neither completely controllable nor completely observable. Fuzzy logic control was demonstrated to successfully control the system and to exhibit desirable robustness properties compared to conventional control.
Author

N92-15877*# Tennessee Univ., Chattanooga. Mechanical Engineering-Mechanics.
REDESIGN OF FLIGHT SPACE SHUTTLE MAIN ENGINE NOZZLE G-15 SEAL AREA BASED ON THE THERMAL ANALYSIS AND FLOW MODELS **c20**
Gary H. McDonald *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21H

The main objective is to understand the present sealing area response to environmental conditions of the supersonic turbulent combustion gases which has led to both stress rupture cracks and hot gas leakage. A review of the existing thermal analysis and flow modeling has been performed of the present design and seal alternatives have been suggested to possibly reduce or eliminate the hot gas flow recirculation problem and the associated seal cracking. Author

N92-15878*# Berry Coll., Mount Berry, GA. Dept. of Physics.
AN INVESTIGATION OF PRE-LAUNCH AND IN-FLIGHT STS RANGE SAFETY RADIO SIGNAL DEGRADATION AND DROPOUT **c32**
Malcolm W. McDonald *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20N

The range safety system (RSS) transmitters operate at a frequency of 416.500 MHz. The transmitting antennas transmit left circularly polarized waves, and the shuttle range safety system (SRSS) receiving antennas onboard the shuttle vehicle receive left circular polarization. Preliminary explanations are proposed for many of the observed fluctuations in signal levels. It is recommended that experiments and further investigation be performed to test the validity of certain of these explanations. Author

N92-15879*# Fisk Univ., Nashville, TN. Dept. of Physics.
GROUND-BASED HIGH ENERGY ASTRONOMY **c89**
Charles H. McGruder, III *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 03A

The specific aim of the project at hand is to study the changes in amplitude and phase of VLF radio waves to see if we can detect the ionospheric disturbance (the change in electron density) caused by a Gamma-Ray burst. The possible advantages of observing gamma-ray bursts through ionospheric disturbances are better localization of burst directions through a large network of VLF receiving points; measurement of total ionizing fluence of gamma-ray bursts; and comparison with satellite data (GOES and GRO) to derive properties of the ionosphere. There is a major problem here: the ionospheric disturbance caused by a Gamma-Ray burst is at best extremely difficult and at worse impossible to detect. So far only one vent has been detected via this method. Therefore, it was decided to study the ionospheric disturbance caused by solar flares first with the hope that they will teach us how to detect the elusive Gamma-Ray bursts. Much is to be learned about the ionosphere and its reaction to impulsive ionization. Author

N92-15880*# University of South Alabama, Mobile. Dept. of Civil Engineering.
LUNAR TRANSIT TELESCOPE LANDER DESIGN **c89**
Husam A. Omar *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 03A

The Program Development group at NASA's Marshall Space Flight Center has been involved in studying the feasibility of placing a 16 meter telescope on the lunar surface to scan the skies using visible/ Ultraviolet/ Infrared light frequencies. The precursor telescope is now called the TRANSIT LUNAR TELESCOPE (LTT). The Program Development Group at Marshall Space Flight Center has been given the task of developing the basic concepts and providing a feasibility study on building such a telescope. The telescope should be simple with minimum weight and volume to fit into one of the available launch vehicles. The preliminary launch date is set for 2005. A study was done to determine the launch vehicle to be used to deliver the telescope to the lunar surface. The TITAN IV/Centaur system was chosen. The engineering challenge was to design the largest possible telescope to fit into the TITAN IV/Centaur launch system. The telescope will be comprised of the primary, secondary and tertiary mirrors and their supporting system in addition to the lander that will land the telescope on the lunar surface and will also serve as the telescope's base. The lunar lander should be designed integrally with the telescope in order to minimize its weight, thus allowing more weight for the telescope and its support components. The objective of this study were to design a lander that meets all the constraints of the launching system. The basic constraints of the TITAN IV/Centaur system are given. Author

N92-15881*# Lenoir-Rhyne Coll., Hickory, NC. Dept. of Physics and Earth Sciences.
THE MAGNITUDE OF THE MAGNETIC FIELD NEAR THE SURFACE OF A HIGH-T(SUB c) SUPERCONDUCTOR WITH A TRAPPED FLUX **c76**
Dan R. Overcash *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20L

In 1986, much excitement was caused by the discovery of a class of materials that conducted electricity with zero resistance at temperatures above the boiling temperature of liquid nitrogen. This excitement was checked by the difficulties of manufacturing ceramics and the usefulness of high temperature superconductors that were restricted by their becoming high resistive conductors at small current densities. A lack of pinning of the magnetic field flux caused the return of high resistance as the current was increased in these materials. A study of the magnetic field near the surface of a high temperature superconductor is the first step in the search for a means of pinning the flux lines and increasing their critical current densities. The author found that a comparison between the defects in the surface of the superconductor and the magnetic field showed only a change in the field near the notch and the edge. No correlation was found between the surface grain or structure and the oscillations in the magnetic field. The observed changes in the magnetic field show resonances which may give an indication of the non-flux pinning in these superconductors. A flux pinning mechanism will increase the critical current densities; therefore, other methods of determining this field should be tried. The author proposes using a flux gate magnetometer with a detector wound on a ferrite core to measure the magnitude and direction of the magnetic field. Author

N92-15882*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
LINEARIZED FORCE REPRESENTATIONS FOR TURBOPUMP LIQUID ANNULAR SEALS **c37**
Alan B. Palazzolo *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11A

The analysis and the accompanying FORTRAN code, SEALPAL1, to simulate liquid annular seals with axial taper, Moody friction factors, and pre-swirl, are discussed. The output of the code includes all dynamic coefficients (stiffness, dampings, and inertias), leakage rate, torque, and horsepower loss. The computer code results were compared with five cases from the literature. The agreement was very good in almost all instances, except

several predicted cross coupled stiffnesses were significantly lower than those appearing in the literature. This disagreement could reflect a theoretical or a programming error by the researcher or in the literature, or it could be a result of the difference in friction factor models or other assumptions employed. Author

N92-15883*# La Grange Coll., GA. Dept. of Physics.
A THEORETICAL STUDY OF THE STEADY STATE OF A SPACE PLASMA **c75**
Michael J. Pangia *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20I

An examination of Vlasov theory of a plasma led to the hypothesis that a plasma may reside in a state of minimal change of the uniform distribution. This statement was made definite by determining that the change in the whole distribution can be minimized if the damping rate were maximized. A preliminary test of the theory shows that one would expect a plasma well fit by a kappa distribution to have a low kappa value. Author

N92-15884*# Florida Univ., Gainesville. Dept. of Physics.
STUDIES OF THE CHARGING OF A THIN DUST LAYER IN A PLASMA **c75**
Lennart R. Peterson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20I

The present study is designed to extend Wilson's model to include refinements in the actual operational design of the simulation code itself and to include additional physics in order to assess the resulting electric field structure and grain charges. Most of the initial phases of the work have focussed on the fact that the code, though in principle reliable, suffers from severe time constraints, requiring as must as 10-50 hours of CPU time for typical runs on a VAX computer. It is likely that by staging the code into steps in which early steps are carried out crudely and later steps successively fine tuned the total CPU time can be cut significantly. Preliminary results indicate the possibility to cut CPU time to as much as 1/3 or 1/5 the former time. The original Wilson code has been carefully examined, tested and documented. Shortcuts and staging systems have been introduced and tested which should make the code produce more accurate results with a finer grid system than would have been feasible heretofor. Continued testing and implementation of these refinements will be carried out at the author's home institution in the near future. In addition to the effort at reducing CPU time to a manageable amount, work is in progress to include a dust-size distribution instead of assuming all dust grains have the same size. Author

N92-15885*# West Virginia Inst. of Tech., Montgomery. Dept. of Electrical Engineering.
SEDS1 MISSION SOFTWARE VERIFICATION USING A SIGNAL SIMULATOR **c61**
William E. Pierson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 09B

The first flight of the Small Expendable Deployer System (SEDS1) is scheduled as the secondary payload of a Delta II in late 1992. The objective of the SEDS1 mission is to collect data to validate the concept of tethered satellite systems and to verify computer simulations used to predict their behavior. A series of tests will be performed to exercise the software modules which make up the Mission Software of the SEDS Data System. These tests will be performed by using a SEDS Signal Simulator to generate signals which will simulate the inputs normally produced by sensors and circuits in the SEDS system. The SEDS Signal Simulator will be used in the debugging and in the formal verification of the SEDS1 Mission Software. The Simulator will not only emulate normal flight conditions but also exercise all modules written to handle anticipated anomalous flight conditions, conditions that would be difficult to reproduce and control with actual SEDS hardware. The simulator will help to expedite software development and to increase the confidence of the users of the Mission Software. With little modification, the Simulator should be useful in the software development of future SEDS flights. Author

N92-15886*# Alabama Univ., Tuscaloosa. Industrial Engineering.
EMERGENCY EGRESS REQUIREMENTS FOR SPACE STATION FREEDOM **c18**
Paul S. Ray *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 22B

An objective was to determine if the pressurized elements and hatchways of the Space Station Freedom support the emergency egress of crewmembers during operation of the station at the stage of Permanently Manned Capacity. Emergency egress was defined as the exit from a pressurized element when an event occurs which makes that element uninhabitable. The possible egress paths for four emergency scenarios considered were: (1) accident occurs in a module and crewmembers translate to the attached node; (2) accident occurs at a node and crewmembers translate through it to the safe node; (3) accident occurs at a module close to a node and crewmembers are not able to translate through the affected area; and (4) accident occurs at a node and crewmembers cannot translate through it. The structural design of the pressurized elements and the hatches studied is adequate for the emergence egress translation requirement. The current location of a few racks may cause some obstruction for egress to the orbiter. The egress time required in the worst situation is estimated to be about 3 mins. There is a chance of getting crewmembers trapped in a module in case of a severe accident. Aids are needed for emergency egress translation. Author

N92-15887*# Alabama Univ., Tuscaloosa. Dept. of Engineering.
USING PROBABILISTIC ANALYSIS TO ASSESS THE RELIABILITY OF PREDICTED SRB AFT-SKIRT STRESSES **c39**
James A. Richardson *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20K

Probabilistic failure analysis is a tool to predict the reliability of a part or system. Probabalistic techniques were used to predict critical stresses which occur in the solid rocket booster aft-skirt during main engine buildup, immediately prior to lift-off. More than any other hold down post (HDP) load component, the Z loads are sensitive to variations in strains and calibration constants. Also, predicted aft-skirt stresses are strongly affected by HDP load variations. Therefore, the instrumented HDP are not effective load transducers for Z loads, and, when used with aft skirt stress indicator equations, yield estimates with large uncertainty. Monte Carlo simulation proved to be a straight forward way of studying the overlapping effects of multiple parameters on predicted equipment performance. An advantage of probabilistic analysis is the degree of uncertainty of each parameter as stated explicitly by its probability distribution. It was noted, however, that the choice of parameter distribution had a large effect on the simulation results. Many times these distributions must be assumed. The engineer who is designing the part should be responsible for the choice of parameter distribution. Author

N92-15888*# Marquette Univ., Milwaukee, WI. Dept. of Electrical and Computer Engineering.
SPACE STATION INTERNAL PROPAGATION **c32**
J. E. Richie *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991

4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20N

The Space Station Freedom (SSF) is planned with a wireless communication system in place for the transmission of information between crew members on board. The clarity of transmission is paramount to an effective system of communication. A short overview is presented of the system including the requirements of interest, and a statement of the problem. The theory used to solve the problem is explored. The results given are for the experiments performed on a mockup of the proposed structure at NASA-Marshall. The requirements on the signal level are that there is a 45 dB signal to noise ratio from end to end, and that coverage over 99 pct. of the volume be maintained. The Rice probability distribution function, a simple extension of the Rayleigh distribution, is used to estimate the field strength inside a volume, where a significant line of sight from the transmitter to the receiver exists. For the SSF, this distribution will correspond to the summation of a coherent line of sight path between the transmitter and the receiver and an incoherent portion. The incoherent portion is the sum of reflections from the walls and the equipment inside the SSF. The Rice distribution was found to be the optimal distribution from the results. Author

N92-15889*# Pittsburgh State Univ., KS. Dept. of Engineering Tech.

SPACE SYSTEM PRODUCTION COST BENEFITS FROM CONTEMPORARY PHILOSOPHIES IN MANAGEMENT AND MANUFACTURING **c83**

Russell L. Rosmait *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05C

The cost of manufacturing space system hardware has always been expensive. The Engineering Cost Group of the Program Planning office at Marshall is attempting to account for cost savings that result from new technologies in manufacturing and management. The objective is to identify and define contemporary philosophies in manufacturing and management. The seven broad categories that make up the areas where technological advances can assist in reducing space system costs are illustrated. Included within these broad categories is a list of the processes or techniques that specifically provide the cost savings within todays design, test, production and operations environments. The processes and techniques listed achieve savings in the following manner: increased productivity; reduced down time; reduced scrap; reduced rework; reduced man hours; and reduced material costs. In addition, it should be noted that cost savings from production and processing improvements effect 20 to 40 pct. of production costs whereas savings from management improvements effects 60 to 80 of production cost. This is important because most efforts in reducing costs are spent trying to reduce cost in the production. Author

N92-15890*# Florida International Univ., Miami. Dept. of Physics.

HIGH VOLTAGE PLASMA SHEATH ANALYSIS RELATED TO TSS-1 **c75**

John W. Sheldon *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20I

On the first mission of the Tethered Satellite System (TSS-1), a 1.8 m diameter spherical satellite will be deployed a distance of 20 km above the space shuttle Orbiter on an insulated conducting tether. The satellite will be held at electric potentials up to 5000 volts positive with respect to the ambient plasma. Due to the passage of the conducting tether through the Earth's magnetic field, an emf will be created, driving electrons down the tether to the orbiter, out through an electron gun into the ionosphere and back into the positive biased satellite. Instrumentation on the satellite will measure electron flow to the surface at several locations, but these detectors have a limited range of acceptance angle. The problem addressed herein is the determination of the electron current distribution over the satellite surface and the angle of incidence of the incoming electrons relative to the surface normal. Author

N92-15891*# Clarkson Univ., Potsdam, NY. Dept. of Civil and Environmental Engineering.

GROUP EVAPORATION **c25**

Hayley H. Shen *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21B

Liquid fuel combustion process is greatly affected by the rate of droplet evaporation. The heat and mass exchanges between gas and liquid couple the dynamics of both phases in all aspects: mass, momentum, and energy. Correct prediction of the evaporation rate is therefore a key issue in engineering design of liquid combustion devices. Current analytical tools for characterizing the behavior of these devices are based on results from a single isolated droplet. Numerous experimental studies have challenged the applicability of these results in a dense spray. To account for the droplets' interaction in a dense spray, a number of theories have been developed in the past decade. Herein, two tasks are examined. One was to study how to implement the existing theoretical results, and the other was to explore the possibility of experimental verifications. The current theoretical results of group evaporation are given for a monodispersed cluster subject to adiabatic conditions. The time evolution of the fluid mechanic and thermodynamic behavior in this cluster is derived. The results given are not in the form of a subscale model for CFD codes. Author

N92-15892*# Alabama Univ., Huntsville. Dept. of Computer Science.

NICKEL HYDROGEN BATTERY EXPERT SYSTEM **c33**

Sajjan G. Shiva *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 10C

The Hubble Telescope Battery Testbed at MSFC uses the Nickel Cadmium (NiCd) Battery Expert System (NICBES-2) which supports the evaluation of performance of Hubble Telescope spacecraft batteries and provides alarm diagnosis and action advice. NICBES-2 provides a reasoning system along with a battery domain knowledge base to achieve this battery health management function. An effort is summarized which was used to modify NICBES-2 to accommodate Nickel Hydrogen (NiH2) battery environment now in MSFC testbed. The NICBES-2 is implemented on a Sun Microsystem and is written in SunOS C and Quintus Prolog. The system now operates in a multitasking environment. NICBES-2 spawns three processes: serial port process (SPP); data handler process (DHP); and the expert system process (ESP) in order to process the telemetry data and provide the status and action advice. NICBES-2 performs orbit data gathering, data evaluation, alarm diagnosis and action advice and status and history display functions. The adaptation of NICBES-2 to work with NiH2 battery environment required modification to all of the three component processes. Author

N92-15893*# Florida Univ., Gainesville. Dept. of Aerospace Engineering, Mechanics and Engineering Science.

DEVELOPMENT OF A PRESSURE BASED MULTIGRID SOLUTION METHOD FOR COMPLEX FLUID FLOWS **c34**

Wei Shyy *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20D

In order to reduce the computational difficulty associated with a single grid (SG) solution procedure, the multigrid (MG) technique

was identified as a useful means for improving the convergence rate of iterative methods. A full MG full approximation storage (FMG/FAS) algorithm is used to solve the incompressible recirculating flow problems in complex geometries. The algorithm is implemented in conjunction with a pressure correction staggered grid type of technique using the curvilinear coordinates. In order to show the performance of the method, two flow configurations, one a square cavity and the other a channel, are used as test problems. Comparisons are made between the iterations, equivalent work units, and CPU time. Besides showing that the MG method can yield substantial speed-up with wide variations in Reynolds number, grid distributions, and geometry, issues such as the convergence characteristics of different grid levels, the choice of convection schemes, and the effectiveness of the basic iteration smoothers are studied. An adaptive grid scheme is also combined with the MG procedure to explore the effects of grid resolution on the MG convergence rate as well as the numerical accuracy.
Author

N92-15894*# Louisiana Coll., Pineville. Dept. of Mathematics and Computer Science.
A HIGH-FIDELITY N-BODY EPHEMERIS GENERATOR FOR SATELLITES IN EARTH ORBIT **c13**
David R. Simmons *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 6 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 22A

A program is currently used for mission planning called the Analytic Satellite Ephemeris Program (ASEP), which produces projected data for orbits that remain fairly close to Earth. Lunar and solar perturbations are taken into account in another program called GRAVE. This project is a revision of GRAVE which incorporates more flexible means of input for initial data, provides additional kinds of output information, and makes use of structured programming techniques to make the program more understandable and reliable. The computer program ORBIT was tested against tracking data for the first 313 days of operation of the CRRES satellite. A sample graph is given comparing the semi-major axis calculated by the program with the values supplied by NORAD. When calculated for points at which CRRES passes through the ascending node, the argument of perigee, the right ascension of the ascending node, and the mean anomaly all stay within about a degree of the corresponding values from NORAD; the inclination of the orbital plane is much closer. The program value of the eccentricity is in error by no more than 0.0002.
Author

N92-15895*# Washington Univ., Saint Louis, MO. Dept. of Civil Engineering.
A STATISTICAL MODEL OF CARBON/CARBON COMPOSITE FAILURE **c24**
Kerry T. Slattery *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11D

A failure model which considers the stochastic nature of the damage accumulation process is essential to assess reliability and to accurately scale the results from standard test specimens to composite structures. A superior filamentary composite for high temperature applications is composed of carbon fibers in a carbon matrix. Carbon-carbon composites are the strongest known material at very high temperatures. Since there appears to be a significant randomness in C-C material strength which cannot be controlled or detected with current technology, a better model of the material failure based upon statistical principles should be used. Simple applications of the model based upon the limited data provide encouraging results that indicate that better design of test specimens would provide a substantially higher prediction for the design strength of C-C composites. An A-basis strength for the C-C tensile rings from a first stage D-5 billets was estimated. A statistical failure model was developed for these rings which indicates that this strength may be very conservative for larger C-C parts. The analysis may be improved by use of a heterogeneous/noncontinuum finite element approach on the minimechanical level.
Author

N92-15896*# Chicago State Univ., IL. Dept. of Mathematics and Computer Science.
TRANSPORT OF PHOTONS PRODUCED BY LIGHTNING IN CLOUDS **c47**
Richard Solakiewicz *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 04B

The optical effects of the light produced by lightning are of interest to atmospheric scientists for a number of reasons. Two techniques are mentioned which are used to explain the nature of these effects: Monte Carlo simulation; and an equivalent medium approach. In the Monte Carlo approach, paths of individual photons are simulated; a photon is said to be scattered if it escapes the cloud, otherwise it is absorbed. In the equivalent medium approach, the cloud is replaced by a single obstacle whose properties are specified by bulk parameters obtained by methods due to Twersky. Herein, Boltzmann transport theory is used to obtain photon intensities. The photons are treated like a Lorentz gas. Only elastic scattering is considered and gravitational effects are neglected. Water droplets comprising a cuboidal cloud are assumed to be spherical and homogeneous. Furthermore, it is assumed that the distribution of droplets in the cloud is uniform and that scattering by air molecules is neglible. The time dependence and five dimensional nature of this problem make it particularly difficult; neither analytic nor numerical solutions are known.
Author

N92-15897*# University of Western Illinois, Macomb. Dept. of Mathematics.
RELIABILITY GROWTH MODELS FOR NASA APPLICATIONS **c38**
Vidya S. Taneja *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 14D

The objective of any reliability growth study is prediction of reliability at some future instant. Another objective is statistical inference, estimation of reliability for reliability demonstration. A cause of concern for the development engineer and management is that reliability demands an excessive number of tests for reliability demonstration. For example, the Space Transportation Main Engine (STME) program requirements call for .99 reliability at 90 pct. confidence for demonstration. This requires running 230 tests with zero failure if a classical binomial model is used. It is therefore also an objective to explore the reliability growth models for reliability demonstration and tracking and their applicability to NASA programs. A reliability growth model is an analytical tool used to monitor the reliability progress during the development program and to establish a test plan to demonstrate an acceptable system reliability.
Author

N92-15898*# California Polytechnic State Univ., San Luis Obispo. Materials Engineering.
CHARACTERIZATION OF THE CORROSION RESISTANCE OF BIOLOGICALLY ACTIVE SOLUTIONS: THE EFFECTS OF ANODIZING AND WELDING **c26**
Daniel W. Walsh *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summr Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11F

An understanding of fabrication processes, metallurgy, electrochemistry, and microbiology is crucial to the resolution of microbiologically influenced corrosion (MIC) problems. The object of this effort was to use AC impedance spectroscopy to characterize the corrosion resistance of Type II anodized aluminum alloy

2219-T87 in sterile and biologically active media and to examine the corrosion resistance of 316L, alloy 2219-T87, and titanium alloy 6-4 in the welded and unwelded conditions. The latter materials were immersed in sterile and biologically active media and corrosion currents were measured using the polarization resistance (DC) technique. Author

N92-15899*# Alabama Univ., Tuscaloosa. Dept. of Mechanical Engineering.
AUTOMATION OF CUTTING AND DRILLING OF COMPOSITE COMPONENTS c31
Charles W. Warren *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 13H

The task was to develop a preliminary plan for an automated system for the cutting and drilling of advanced aerospace composite components. The goal was to automate the production of these components, but the technology developed can be readily extended to other systems. There is an excellent opportunity for developing a state of the art automated system for the cutting and drilling of large composite components at NASA-Marshall. Most of the major system components are in place: the robot, the water jet pump, and the off-line programming system. The drilling system and the part location system are the only major components that need to be developed. Also, another water jet nozzle and a small amount of high pressure plumbing need to be purchased from, and installed. Author

N92-15900*# Utah State Univ., Logan. Dept. of Industrial Technology.
HP9-4-.30 WELD PROPERTIES AND MICROSTRUCTURE c26
George W. Watt *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 11F

HP9-4-.30, ultra high strength steel, the case material for the Advanced Solid Rocket Motor (ASRM), must exhibit acceptable strength, ductility, toughness, and stress corrosion cracking (SCC) resistance after welding and a local post weld heat treatment (PWHT). Testing, to date, shows that the base metal (BM) properties are more than adequate for the anticipated launch loads. Tensile tests of test specimens taken transverse to the weld show that the weld metal overmatches the BM even in the PWHT condition. However, that is still some question about the toughness and SCC resistance of the weld metal in the as welded and post weld heat treated condition. To help clarify the as welded and post weld heat treated mechanical behavior of the alloy, subsize tensile specimens from the BM, the fusion zone (FZ) with and without PWHT, and the heat affected zone (HAZ) with and without PWHT were tested to failure and the fracture surfaces subsequently examined with a scanning electron microscope. Results are given and briefly discussed. Author

N92-15901*# Arkansas Univ., Fayetteville. Dept. of Mechanical Engineering.
COMPUTERIZED REDUCTION OF ELEMENTARY REACTION SETS FOR COMBUSTION MODELING c25
Carl V. Wikstrom *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 21B

If the entire set of elementary reactions is to be solved in the modeling of chemistry in computational fluid dynamics, a set of stiff ordinary differential equations must be integrated. Some of the reactions take place at very high rates, requiring short time steps, while others take place more slowly and make little progress in the short time step integration. The goal is to develop a procedure to automatically obtain sets of finite rate equations, consistent with a partial equilibrium assumptions, from an elementary set appropriate to local conditions. The possibility of computerized reaction reduction was demonstrated. However, the ability to use the reduced reaction set depends on the ability of the CFD approach in incorporate partial equilibrium calculations into the computer code. Therefore, the results should be tested on a code with partial equilibrium capability. Author

N92-15902*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
ASSESSMENT OF THE NASA CODE FDNS2D FOR COMPUTATION OF FILM COOLING EFFECTIVENESS c34
Keith A. Woodbury *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 20D

The role of computational fluid dynamics (CFD) programs is usually one of analysis. Generally they are not used in the design phase of a project. There was an effort to integrate CFD codes into the design phase of combustion devices, specifically, in the design of the Space Transportation Main Engine (STME) nozzle. Before the results of such analyses can be accepted, the credibility of the CFD codes upon which they are based must be established. The effort to assess the capability of the NASA code FDNS2D to compute the heat transfer to a solid bounding surface is detailed. Specifically, high speed flow over a flat plate is considered, and the resulting wall shear stress, and heat transfer are computed. These values are compared against analytical results (for wall shear stress) and experimental data (for heat transfer). A brief description is given of the FDNS2D code, with special emphasis on how it handles solid wall boundary conditions. The flow conditions and the FDNS solution are presented, along with comparison to analytical and experimental data. Some intermediate observations are then made, followed by a recommendation for adoption of an alternate method for computing the wall heat flux. Author

N92-15903# National Science Foundation, Washington, DC.
SCIENCE AND ENGINEERING DOCTORATES: 1960-90 Final Report
Susan T. Hill 1990 231 p *Its* Surveys of Science Resources Series
(NSF-91-310) Avail: NTIS HC/MF A11

This report is the ninth in a series based on data from the annual Survey of Earned Doctorates conducted by the National Academy of Sciences/National Research Council for the National Science Foundation. Data are presented on science and engineering doctoral awards for 1960 through 1990. Survey forms are distributed to all regionally-accredited universities in the United States and its territories (e.g., Puerto Rico) that confer research doctorates. The data presented here are about doctoral graduates and provide statistics that can guide improvement of graduate education. About 93 percent of those who received questionnaires responded. J.P.S.

N92-15904# National Science Foundation, Washington, DC. Science and Engineering Education Program.
SELECTED DATA ON GRADUATE STUDENTS AND POSTDOCTORATES IN SCIENCE AND ENGINEERING: FALL 1990
1991 63 p
(NSF-91-320) Avail: NTIS HC/MF A04

Data presented in these tables are derived from the National Science Foundation/National Institutes of Health survey of graduate science and engineering students and postdoctorates, fall 1990. Unless otherwise specified, the published data represent estimates of total enrollment in science and engineering (S&E) programs in approximately 10,400 graduate departments at some 730 institutions in the United States and outlying areas. Survey responses were received from 98 percent of the 610 institutions granting advanced S&E degrees. Total graduate enrollment in the science, engineering, and health fields reached nearly 459,000 in fall 1990, the largest single-year increase in recent years - more

than 4 percent over the fall 1989 total. The increase was sharpest in the health fields, more than 6 percent, compared to a 4 percent growth in both the science and engineering fields. The number of students increased more in psychology than in any other science field. Growth was slowest in agricultural sciences. The social sciences continued to be the most popular field, with 78,600 graduate students or more than one-sixth of the total. Nearly one-third of the engineering graduate students, 34,900, were enrolled in electrical engineering. The number of graduate students enrolled part time increased at a more rapid rate that did the number enrolled full time, 6 percent compared to just over 3 percent. Part-time students made up about one-third of all S&E graduate students. Enrollment in doctorate-granting institutions, at 398,400, represented 87 percent of all graduate students. This proportion has varied only slightly since the survey series began in 1975. J.P.S.

N92-15905# National Science Foundation, Washington, DC.
CHARACTERISTICS OF SCIENCE/ENGINEERING EQUIPMENT IN ACADEMIC SETTINGS: 1989-90
Kenneth Burgdorf (Westat Research, Inc., Bethesda, MD.) May 1991 51 p
(NSF-91-315) Avail: NTIS HC/MF A04

This monograph is one in a series of analytical reports presenting findings from the National Science Foundation's 1989-90 National Survey of Academic Research Instruments and Instrumentation Needs. It describes the current (1988-89) stock of movable science/engineering equipment in the $10,000 to $999,999 price range at the nation's research-performing colleges, universities, and medical schools. The text summarizes study findings concerning the amount, cost, age, and other characteristics of five major types of equipment (computers, spectrometers, microscopes, bioanalysis equipment, and all other equipment). Appendix tables present more detailed information for 28 types and subtypes of equipment. The findings are based on multistage samples of 11,575 instruments from 1,188 science/engineering departments and research centers at 79 institutions: 55 colleges and universities and 24 medical schools. The study is limited to equipment assigned to academic departments and research centers in engineering, chemistry, physics/astronomy, and the agricultural, biological, computer, and environmental sciences. The sample data are statistically weighted to represent a universe of institutions that collectively account for over 90 percent of the nation's academic R&D expenditures in the above fields. The survey response rates are 90 percent or more at all sampling levels. Author

N92-15906# National Science Foundation, Washington, DC. Div. of Science Resources Studies.
WOMEN AND MINORITIES IN SCIENCE AND ENGINEERING
Jan. 1990 174 p
(NSF-90-301) Avail: NTIS HC/MF A08

This report, the fifth in a biennial series mandated by the Science and Technology Equal Opportunities Act of 1980, presents information on the participation of women, racial/ethnic minorities, and persons with physical disabilities in science and engineering (S&E). In keeping with its purpose as an information resource, this report makes no recommendations on programs or policies. The report does present information that may be used to address issues concerned with the full utilization of the Nation's human resources in science and engineering. Several major themes emerge from the data and analyses in this report: (1) Despite rapid growth between 1978 and 1988, women, blacks, and Hispanics continue to be underrepresented in S&E employment based on their representation in the overall U.S. workforce. (2) Underrepresentation is more acute in engineering and some natural science fields than in the life or social sciences. (3) The general underrepresentation of women and minorities reflects a number of factors, including their relatively low participation in precollege science and mathematics courses and in undergraduate and graduate science and engineering education programs. (4) Women and minorities who complete their education in S&E fields and seek employment in the S&E workforce generally encounter higher unemployment rates and earn lower annual salaries that the majority. (5) The fundamental concern for underrepresented minorities is the quality of their educational experiences. Lower performance by these groups in mathematics and science emerges as early as the elementary school level. Specific findings presented in this report on women, racial minorities, Hispanics, and persons with physical disabilities are summarized. The report is designed to provide essential information to Congress, the Administration, and others concerned with both the overall strength of U.S. science and engineering and the provision of equal opportunities and equal treatment for women and minorities in this area. Author

N92-15907# National Science Foundation, Washington, DC. Directorate for Education and Human Resources.
MATCHING ACTIONS AND CHALLENGES
Dale Ewen and David Mertes May 1991 23 p Presented at a NSF Workshop on Science, Engineering, and Mathematics Education in Two-Year Colleges, Washington, DC, 13-14 May 1991
(NSF-91-111) Avail: NTIS HC/MF A03

Sixty instructional faculty and administrators from two-year colleges met with National Science Foundation (NSF) staff to discuss concerns, to develop strategies for addressing critical issues, and to state specific recommendations for improving the quality of science, mathematics, engineering, and technology education. The focus of this workshop was to reaffirm the important role that two-year colleges play in the education of the nation's undergraduates, especially since community, junior, and technical colleges often serve as institutions of choice for minority and other underrepresented student populations. In particular, they recommended: (1) the expansion of NSF's faculty enhancement program to include a comprehensive program designed for faculty who emphasize lower division collegiate education; (2) encouragement and support by NSF and other agencies for the development of curricula to meet the needs of increasingly diverse groups of students; and (3) concrete steps that all involved could take to make it possible for community college faculty to assume their leadership roles in these activities. Author

N92-15908# Oak Ridge National Lab., TN.
SCIENCE IN ACTION: AN INTERDISCIPLINARY SCIENCE EDUCATION PROGRAM
L. L. Horton 1991 4 p Presented at the National Educators Workshop, Oak Ridge, TN, 12-14 Nov. 1991
(Contract DE-AC05-84OR-21400)
(DE92-002051; CONF-9111111-2) Avail: NTIS HC/MF A01

Science in Action is an education outreach program for pre-collegiate students. It is based on the concept that, in order to interest students in science, they must see science and scientists at work. The program encompasses the full range of scientific disciplines: the core sciences, engineering, and mathematics. A unique aspect of the program is the involvement and support of scientists and engineers representing local professional societies, industries, businesses, and academic institutions. The goal of the presentations is to be highly interactive. The students have some 'hands on' experiences and leave with a good feeling about science and engineering. To present a broad spectrum of role models, scientists and engineers were involved as presenters, guides, and exhibitors. DOE

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N92-15909# National Science Foundation, Washington, DC.
REPORT OF THE MERIT REVIEW TASK FORCE
23 Aug. 1990 26 p
(NSF-90-113) Avail: NTIS HC/MF A03

National Science Foundation Director Erich Bloch (1984-1990) established the Merit Review Task Force to analyze the merit review process as it is practiced in the Foundation and to assess

its impact on the workloads of the external science and engineering community and on the Agency's program staff. The Task Force focused on individual investigator proposals submitted to the disciplinary directorates, since these represent the majority of NSF proposals and have the largest impact on the merit review system. Existing data were examined, and both the growth in traditional disciplinary programs and the impact of new initiatives and cross-directorate programs were reviewed. The Task Force concurred with the finding of previous studies of the merit review system: the system is remarkable fair and is an effective mechanism for identifying and funding high-quality proposals in every discipline the Foundation supports. Many consider it to be the best system in the world. However, the study indicates that the system has become overburdened and creativity and innovation are being threatened. Changes are recommended to improve the system and reduce barriers and burdens that have grown over time. Many of these recommendations are for improvements in NSF's internal operations; others involve significant changes in the way proposals are prepared and reviewed. Author

N92-15910# National Science Foundation, Washington, DC.
GUIDE TO PROGRAMS, FISCAL YEAR 1992
1991 84 p
(NSF-91-80) Avail: NTIS HC/MF A05; also available SOD HC $4.50 as 038-000-00586-3

This publication lists scientific and engineering programs that the National Science Foundation (NSF) is interested in funding, scholarship and fellowship opportunities, and information for anyone wanting to submit an unsolicited proposal. A reference is given to a brochure that provides guidance for writing and submitting proposals. Eligibility information, deadlines, and contacts are also provided. NSF generally does not support clinical research, drug testing programs, technical assistance, pilot plant efforts, research requiring security classification, commercial product development, or market research for a particular product or invention. Proposals considered for funding are for support of research and education in science; they include, but are not limited to, the following disciplines: astronomy, atmospheric sciences, biological and behavioral sciences, chemistry, computer sciences, earth sciences, engineering, information science, materials research, mathematical sciences, oceanography, physics, and social sciences. Interdisciplinary proposals also are eligible for consideration. Most proposals come to NSF from educational institutions and other organizations, some commercial, but individuals may submit proposals under special circumstances. NSF encourages collaborative efforts between or among educators, industry, and governmental agencies, as well as proposals from women, members of minority groups, small businesses, and individuals with handicaps. Normally, unsolicited proposals require that the awardee share the cost of the project; solicited proposals may provide for the payment of all costs. Proposals in response to specific program announcements should so indicate. J.P.S.

N92-15911# National Science Foundation, Washington, DC.
INTERNATIONAL SCIENCE AND TECHNOLOGY DATA UPDATE: 1991
Deborah R. Cichon Apr. 1991 139 p *Its* Surveys of Science Resources Series
(NSF-91-309) Avail: NTIS HC/MF A07

This is the 1990 edition of an annual publication designed to provide quick reference to quantitative information on international science and technology (S&T) resource indicators. Charts and summary highlights compare S&T data for the European Community and seven major industrialized countries - France, West Germany, Italy, Japan, Sweden, the United States, and the United Kingdom. Graphic representations and explanatory paragraphs are presented on the left-hand pages of the report; supporting data are in the tables opposite. New S&T indicators and data for Italy and Sweden are presented in this issue for the first time. The statistics include data on national expenditures in research and development, human resources for science and technology, and research outputs, including publications and productivity. J.P.S.

N92-15912# Naval Postgraduate School, Monterey, CA.
EFFECT OF PRIME CONTRACTOR FINANCIAL POSITION ON MAJOR WEAPON SYSTEM COST AND DELIVERY PERFORMANCE M.S. Thesis
James D. Peters Dec. 1990 48 p
(AD-A242431) Avail: NTIS HC/MF A03 CSCL 15/1

This thesis investigates the relationship of prime contractor cost and delivery performance with prime contractor financial health. The analysis used DOD major acquisition programs. Regression was used to analyze the relationship between outcome measures reflecting cost and schedule growth and summary indexes of financial health, constructed using indexes computed from financial distress models. The summary indexes were used to indicate contractor financial health, and change in financial health, before and during both development and production phases of a program. Major findings indicate that a relationship does exist between financial condition and contractor performance, but the relationship is small. GRA

N92-15856*# Mississippi State Univ., Mississippi State. Dept. of Industrial Engineering.
EVALUATION OF SCHEDULING TECHNIQUES FOR PAYLOAD ACTIVITY PLANNING
Stanley F. Bullington *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-088-021)
Avail: NTIS HC/MF A12 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N92-15913# Naval Ocean Systems Center, San Diego, CA.
WHITE PAPER ON THE DATABASE MANAGEMENT SYSTEM INTERFACE STANDARD FOR NAVY NEXT GENERATION COMPUTING RESOURCES (NGCR) Final Report, Nov. 1986 - May 1991
D. L. Small, M. C. Butterbrodt, and R. M. Berman Jul. 1991 61 p
(AD-A241062; NOSC/TD-2116) Avail: NTIS HC/MF A04 CSCL 12/7

A white paper (technical document) presents the advanced analysis, investigation, and planning regarding the issues facing the Database Management System Interface Working Group (DBWG) involved with the Navy's Next Generation Computing Resources (NGCR) program. It also provides a starting point for discussions when the DBWG is initiated in FY92. At the time of its writing, this document represents a snapshot of the Navy's use of a database management system (DBMS) technology for command, control, and combat systems. GRA

N92-15914# California Univ., Berkeley. Lawrence Berkeley Lab.
FROM CHAOS TO ORDER: THE MICROSTAR DATA ACQUISITION AND ANALYSIS SYSTEM
W. Rathbun Mar. 1991 55 p
(Contract DE-AC03-76SF-00098)
(DE92-000663; LBL-29734) Avail: NTIS HC/MF A04

The MicroStar data acquisition and analysis software consists of several independent processes, although to the user it looks like a single program. These programs handle such functions as data acquisition (if any), data analysis, interactive display and data manipulation, and process monitoring and control. An overview of these processes and functions can be found in the paper as well as a more detailed description and users' guide. DOE

N92-15915# California Univ., Berkeley. Lawrence Berkeley Lab.
METABROWSER: A COMBINED BROWSING, QUERY, AND ANALYSIS TOOL
A. Shoshani and E. Szeto Apr. 1991 21 p
(Contract DE-AC03-76SF-00098)
(DE92-000714; LBL-30953) Avail: NTIS HC/MF A03

The MetaBrowser design is based on the premise that scientists should not be forced to learn new languages or commands for finding the data they are interested in and for selecting subsets of the data for further analysis. Furthermore, there should be a single system that permits browsing, query, and analysis of the data, so that the scientist does not have to switch between systems. The current version for the MetaBrowser was designed for the DOE Comprehensive Epidemiological Data Resource (CEDR) project, but the same principles can apply to other scientific disciplines. Browsing and query should be combined. It is quite natural for a user to explore the information in the database before deciding what subset of the data to select for further analysis. In general, if there is a large number of datasets (i.e., databases) in the system, then the user would want to find out information about the various datasets (called metadata), before choosing one or more datasets for further exploration. Thus, a metadatabase that holds information about datasets in the systems must exist.
DOE

N92-15916# Argonne National Lab., IL.
QUERYING GENOMIC DATABASES
A. Baehr, R. Hagstrom, D. Joerg, and R. Overbeek Sep. 1991 48 p
(Contract W-31-109-eng-38)
(DE92-001663; ANL/MCS-TM-155) Avail: NTIS HC/MF A03

A natural-language interface has been developed that retrieves genomic information by using a simple subset of English. The interface spares the biologist from the task of learning database-specific query languages and computer programming. Currently, the interface deals with the E. coli genome. It can, however, be readily extended and shows promise as a means of easy access to other sequenced genomic databases as well.
DOE

N92-15917# Nijmegen Univ. (Netherlands). Dept. of Information Systems.
THE EFFECTIVENESS OF NAVIGABLE INFORMATION DISCLOSURE SYSTEMS
P. D. Bruza, F. J. M. Bosman, and R. W. T. Bouwman Apr. 1991 13 p Sponsored in part by EEC
(TR-91-11; ETN-92-90538) Avail: NTIS HC/MF A03

The retrieval effectiveness of a lattice structured hypertext of indexing information (hyperindex) against a semantic classification system organized as a hierarchical hypertext is compared. The former is shown to be superior to the latter using formal criteria employed in an experimental setting. The automatic derivation of so called index expressions from multilingual information is also elucidated. From these index expressions it is shown how the hyperindex can be generated.
ESA

N92-15918# European Space Agency, Paris (France).
AOS HANDBOOK: A USER'S GUIDE TO THE CCSDS STANDARDS FOR ADVANCED ORBITING SYSTEMS
D. Stanton and W. R. Burke, ed. Jul. 1991 67 p
(ESA-TM-14; ISBN-92-9092-213-3; ISSN-1013-7076; ETN-92-90682) Copyright Avail: NTIS HC/MF A04

This Advanced Orbiting Systems (AOS) handbook is intended to help implementers and users of communications and data handling systems who are adhering to the Consultative Committee for Space Data Systems (CCSDS) recommendation for AOS. The handbook provides a summary of the philosophy and contents of the AOS recommendation, evaluates issues which could not be discussed in the recommendation itself, and provides answers to some of the implementation aspects of the recommendation. The AOS services and protocols are presented. The interoperability in the space segment and in permanent installations is scheduled. Some aspects of the virtual channel algorithm, the synchronous virtual channel, the data integrity, the link performance, the isochronous services and the tape recording are discussed. Space and ground segment aspects and network management are underlined.
ESA

N92-15919# Dove Electronics, Inc., Rome, NY.
ACTIVE DATA/KNOWLEDGE BASE DICTIONARY Final Technical Report, Aug. 1989 - Apr. 1991
J. Dove, L. Kerschberg, P. Berra, C. Bosch, and D. Weishar Sep. 1991 127 p
(Contract F30602-89-C-0068)
(AD-A242436; RL-TR-91-231) Avail: NTIS HC/MF A07 CSCL 12/7

This effort was to explore data and knowledge based processing systems with particular attention to: (1) Adequacy of the Information Resource Dictionary Systems (IRDS) to support advanced systems development projects: (2) Conceptual architecture for an Active Data/Knowledge Dictionary System; (3) Exploring in detail intelligent query formulation and processing in heterogeneous database systems; coordinated problem solving with multiple heterogeneous knowledge sources; schema evolution in object oriented database; Hypermedia requirements for active dictionaries, and providing a better understanding of the role of metadata in the management of knowledge-intensive object-oriented applications.
GRA

N92-15920# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
UTC-PAB NORMATIVE DATABASE (PABNORM) Annual Report, 1 Oct. 1989 - 22 Nov. 1990
Gary B. Reid 26 Nov. 1990 6 p
(DA Proj. 3M2-63002-D-995)
(AD-A242456) Avail: NTIS HC/MF A02 CSCL 12/6

A contract with the University of Oklahoma (UOK) was accomplished with a start date of 5 June 1990. Six government-owned computer systems (Zenith Z-248) were configured with sRL LabPak boards and test battery software, tested, and shipped to UOK. A test protocol was approved by the UOK institutional Review Board for use of Human Subjects. Scientific progress during the past year included a contract that was made with the new OMPAT bulletin board system (BBS) and maintained throughout the year by logging on the BBS no less than twice per week. New UTCPAB, Walter Reed Army Institute of Research (WRAIR), CCAB, and Naval Aerospace Medical Research Laboratory (NAMRL), AGARD Simulator Training Requirements and Effectiveness Study (STRES) Battery software was downloaded and installed on laboratory computer systems. Small amounts of data were collected at the Armstrong Aerospace Medical research Laboratory (AAMRL) using the tests from the WRAIR and the NAMRL AGARD Batteries. The data seem comparable to that obtained with similar tasks from the CTS. A large scale data collection effort will be accomplished at UOK in order to confirm these findings.
GRA

N92-15921# Naval Research Lab., Washington, DC.
PREPARING A SUBLANGUAGE GRAMMAR Final Report, 1984 - 1988
Dennis Perzanowski and Elaine Marsh 31 Oct. 1991 30 p
(Proj. RS3-4-C-74)
(AD-A242464; NRL-9351) Avail: NTIS HC/MF A03 CSCL 05/7

The first step in preparing a sublanguage grammar to parse a given set of messages in a particular subdomain, namely Navy Casualty Reports (CASREPs) of the failure of Starting Air Compressors, was the porting of an English grammar from The Linguistic String project (LSP) at New York University. This grammar consists of (1) a set of Backus-Naur Form (BNF) productions in the Syntactic Component; (2) a series of LISTs in the LIST Component where generalizations are further codified, making the processing of sentences more efficient; (3) a set of syntactic semantic Restrictions in the Restriction Component that constrains the productions of the grammar further; (4) a set of syntactic

transformations and regularizations in the Transformation Component that regularizes the various types of sentences parsed into similar structures; and (5) a set of Formatting Rules in an Information Formatting Component that maps syntactic structures into information structures. In this report, we will be concerned only with the adaptations made to the syntactic or BNF Component, to the LIST Component, and to the Restriction Component. GRA

N92-15922# Arkansas Univ., Fayetteville.
A COMPARISON OF MANUAL AND AUTOMATED METHODS FOR DELIMITING WATERSHEDS FOR USE WITH GRASS/GIS SOFTWARE Final Report
J. J. Lockhart Sep. 1991 31 p
(Contract DACA88-87-D-0008)
(AD-A242633; CERL-TR-N-91/34) Avail: NTIS HC/MF A03 CSCL 08/8

The Geographic Resources Analysis Support System (GRASS) is a geographic information and image processing system originally designed to serve land managers and environmental planners at Army installations. Among the newer automated processes performed by GRASS is the digital computation of watersheds. This report compares the GRASS version 3.0a watershed module with the manual delineation of watersheds, by applying the two methods to installation data taken from Fort Chaffee, Arkansas, a facility with other 72,000 acres of highly variable terrain. This study showed that both methods produced similar results, with some exceptions. In areas of pronounced relief, 7.5-minute data and 1-degree data did produce watersheds, but did not indicate subtle saddle-based boundaries. At the installation scale, the 1-degree data produced adequate major watershed delineation, but was not adequate to determine minor watersheds. The more accurate 7.5-minute data produced a large number of subbasins. The automated method produced good subwatershed basin delineation in areas of greater relief, but produced unsatisfactory delineation in areas of moderate to lower relief. GRA

N92-15923# New Mexico State Univ., Las Cruces. Knowledge Systems Group.
DEVELOPMENT OF ADVANCED COMPUTING TECHNOLOGY FOR OPTIMIZING THE USE OF METEOROLOGICAL DATABASES: MERCURY EVALUATION Final Report
C. A. Fields Oct. 1991 63 p
(Contract DAAD07-86-C-0034)
(AD-A242669; ASL-CR-91-0034-3) Avail: NTIS HC/MF A04 CSCL 04/2

This document reports the development of the MERCURY mesoscale meteorological data fusion system between 1 October 1989 and 30 September 1990. MERCURY will function as an intelligent, autonomous software interface between the data ingestion and management facilities of a future version of the integrated meteorological system, or a similar system, and tactical decision aids that require meteorological data as input. This report describes the current state of MERCURY and the procedures being used for evaluation. It also presents representative test results obtained in the Los Angeles basin area during July 1990. GRA

N92-15924# Naval Postgraduate School, Monterey, CA.
CONSIDERATIONS FOR CONVERSION OF MICROFICHE TO OPTICAL STORAGE M.S. Thesis
John D. Fowler and Robert W. Clipper, Jr. Mar. 1991 156 p
(AD-A242670) Avail: NTIS HC/MF A08 CSCL 12/6

Information maintained in a digital format which enables full-text search and retrieval capabilities provides significant advantages over hard-copy or microfiche based information. Recent advances in optical storage technology and full-text retrieval software have made it possible to maintain and access large information bases quickly and inexpensively. Conversion from existing microfiche format to an optical format is possible, but still quite expensive. A case study concerning conversion of microfiche from the Naval Postgraduate School Knox Library Research Reports Division is presented to demonstrate the costs and benefits of having information in a full-text format. Alternative to full backfile conversion are presented with policy recommendations for organizations considering implementing optical storage systems. GRA

N92-15925# Naval Postgraduate School, Monterey, CA.
AN ANALYSIS OF DATA VALIDITY FOR MEASURES OF EFFECTIVENESS OF INFORMATION SYSTEMS M.S. Thesis
Gregory M. Regens Mar. 1991 166 p
(AD-A242684) Avail: NTIS HC/MF A08 CSCL 05/2

This thesis examines validity issues associated with the use of data collection techniques in information systems research. It presents an analysis of 37 studies that purported to empirically assess the effectiveness of information systems. These studies were evaluated to determine the validity of measures of effectiveness of information systems. Each study was reviewed to identify (1) data collection techniques used, (2) purported measures of the techniques, (3) ways in which the techniques were administered, and (4) discussions of validity issues arising from the use of the techniques. Findings indicate that information systems researchers have adopted data collection techniques commonly used by social scientists; however, they largely ignore or are unaware of associated validity issues. Over three-quarter of the studies involved questionnaires and fewer than a quarter addressed validity issues. Consequently, the credibility of information systems research is vulnerable to challenge. GRA

N92-15926# Naval Postgraduate School, Monterey, CA.
A COST-EFFECTIVENESS ANALYSIS OF ALTERNATIVE GUIDED MEDIA FOR THE BACKBONE CABLE PLANT PORTION OF THE BASE INFORMATION TRANSFER SYSTEM M.S. Thesis
Vernon M. Skelly Mar. 1991 68 p
(AD-A242688) Avail: NTIS HC/MF A04 CSCL 25/5

The Base Information Transfer System (BITS) and the Telephone Modernization Plan (TMP) will upgrade the backbone cable plant of the telephone system on Navy bases. Using a hypothetical Navy base and its existing twisted-pair wire network, this paper analyzes the unique costs of optical fiber and twisted-pair wire for four installation options: immediate installation of optical fiber; time-phased installation of optical fiber; time-phased installation of twisted-pair wire in trenches; and time-phased installation of twisted-pair wire in existing conduit. The cost analysis indicates that the lowest cost option is twisted-pair wire installed in conduit. However, the cost-effectiveness analysis concludes that time-phased installation of optical fiber is the best alternative due to its performance characteristics. GRA

N92-15927# Army Cold Regions Research and Engineering Lab., Hanover, NH.
CRREL TECHNICAL PUBLICATIONS: SUPPLEMENT 1976-1990
1990 370 p
(AD-A242718) Avail: NTIS HC/MF A16 CSCL 08/12

Effective scientific and technical research depends on the transfer of information throughout the scientific community as well as general dissemination of information to the public. This publications list is the supplement to the Cold Regions Research and Engineering Laboratory Publications List dated December 1975. It includes all the world's cold regions research. GRA

N92-15928# Naval Postgraduate School, Monterey, CA.
CORPORATE INFORMATION MANAGEMENT: A CASE STUDY M.S. Thesis
David D. Schweizer and James P. Steele, III Mar. 1991 235 p
(AD-A242762) Avail: NTIS HC/MF A11 CSCL 05/1

This thesis documents in a case format the events, environment and decisions in the genesis and evolution of the Department of Defense's Corporate information Management initiative. GRA

N92-15929# Naval Postgraduate School, Monterey, CA.
THE PROBLEM OF UNIQUE NAME VIOLATIONS IN DATABASE INTEGRATION M.S. Thesis
Renae M. Beyer Mar. 1991 146 p
(AD-A242823) Avail: NTIS HC/MF A07 CSCL 12/7

When multiple database schemas are integrated, there are often conflicts in the naming of attributes within the schemas. These conflicts must be detected and resolved prior to successful integration of the schemas. This thesis describes a method for automatically detecting such naming conflicts, which adapts and enhances a method for detecting similar conflicts in (mathematical) model integration. The method relies on the representation of semantic information, not found in data dictionaries, about the data elements or attributes present in the various schemas. This information about data elements is then used by mechanical inference procedures to automatically determine whether two distinctly named elements in fact represent the same object (the synonym problem), or if data elements with the same name in different schemas actually represent different objects (the homonym problem). The expected accuracy and errors of these procedures, and results obtained from a set of experiments on the use of this method, are also presented. GRA

N92-15930# Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil).
IPEN SCIENTIFIC AND TECHNICAL PRODUCTION, 1989
1990 52 p In PORTUGESE
(DE91-640776; INIS-BR-2630) Avail: NTIS HC/MF A04

Since its foundations in 1956, the main objective of the Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, Brazil, has been to undertake research and development into peaceful uses of nuclear energy and to train scientific personnel at the post-graduate level. This document gathers the literary production of the IPEN researchers received by the IPEN library in 1989. It includes 239 bibliographic records. DOE

N92-15417# Osservatorio Geofisico Sperimentale, Trieste (Italy).
MARINE DATA MANAGEMENT AT OSSERVATORIO GEOFISICO SPERIMENTALE
Beniamino Manca *In* Institute of Oceanographic Sciences, European Marine Atlases: Current Trends and Future Directions 1991 p 63-69 (For primary document see N92-15407 06-43)
Avail: NTIS HC/MF A04; Inst. of Oceanographic Sciences, Deacon Lab., Wormley, Godalming, Surrey GU8 5UB, England, HC 21 sterling pounds

N92-15473*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INFORMATION DATA SYSTEMS FOR A GLOBAL CHANGE TECHNOLOGY INITIATIVE ARCHITECTURE TRADE STUDY
Nicholas D. Murray *In its* Global Change Technology Architecture Trade Study Sep. 1991 p 309-338 (For primary document see N92-15464 06-45)
Avail: NTIS HC/MF A17 CSCL 05B

N92-15852*# Alabama A & M Univ., Huntsville. Dept. of Mathematics.
OVERHAULING, UPDATING AND AUGMENTING NASA SPACELINK ELECTRONIC INFORMATION SYSTEM
Jean A. Blake *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 3 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05B

N92-15863*# University of Southern Mississippi, Hattiesburg. Dept. of Management Information Systems.
RECOMMENDATIONS FOR AN EXECUTIVE INFORMATION SYSTEM (EIS) FOR THE NASA ACCOUNTING AND FINANCIAL INFORMATION SYSTEM (NAFIS)
Ernest Preston Goss *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 3 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N92-15931# National Science Foundation, Washington, DC.
PLANNED R AND D EXPENDITURES OF MAJOR US FIRMS: 1990-91
John R. Gawalt, Howard H. Garrison, Millicent V. Gough, ed., and Elizabeth J. Michael, ed. 1991 41 p *Its* Surveys of Science Resources Series
(NSF-91-306) Avail: NTIS HC/MF A03

This report provides information on the 1990 and 1991 research and development (R&D) plans of 144 of the U.S. companies that are most active in R&D. In 1990, the responding firms planned a total increase in domestic R&D expenditures of 3.9 percent, a decrease of 0.3 percent in constant-dollar terms. For 1991, the total increase planned was 4.3 percent, a decline of 0.1 percent in constant-dollar terms. Forecasts of growth exceeded forecasts of decline in every industry except aircraft and missiles, for both years. The industries that predicted the largest increases in 1990 were the industrial and other chemicals industry, 9.7 percent; and computer services at 8.9 percent; in 1991, they were the pharmaceutical industry at 8.0 percent; computer services, 7.0 percent; and petroleum refining and extraction firms, 6.7 percent. The aircraft and missiles industry predicted a 3.0 percent drop in 1990 and a 1.7 drop in 1991. For the 52 firms that operate both foreign and domestic R&D facilities, the percentage of the budget allocated to foreign laboratories increased over the 1985-89 period from 11 percent to 16 percent. Major factors influencing predicted changes (or stability) in budgeting R&D are provided. The report was compiled from telephone interviews with members of the National Science Foundation's Industrial Panel on Science and Technology which is made up of corporate R&D directors. J.P.S.

N92-15932# Bundesministerium fuer Wirtschaft, Bonn (Germany, F.R.).
THE COMPETITIVE SITUATION OF THE GERMAN AIR AND SPACE NAVIGATION INDUSTRY, AS COMPARED TO THE INTERNATIONAL SITUATION [DIE KONKURRENZSITUATION DER DEUTSCHEN LUFT- UND RAUMFAHRT IM INTERNATIONALEN VERGLEICH]
1991 78 p In GERMAN
(BMWi-307; ISSN-0342-9288; ETN-92-90597) Avail: NTIS HC/MF A05

The position of the German air and space navigation industry is considered, with regard to other developed countries, and more particularly to the European competition. The most important European companies are compared. Political and economic aspects of competition are considered. The productivity of the various countries is compared. Taxes and subventions are reported. The German equipment industry is described. The importance of research and development and the huge capital requirements with regard to very long term capital investments are emphasized as the characteristic features of the air and space navigation industry with regard to other economic activities. ESA

N92-15933 Loughborough Univ. of Technology (England). Dept. of Transport Technology.
IMPLICATIONS IN THE DECLINE OF THE BRITISH MERCHANT NAVY
E. J. Gubbins May 1991 40 p
(TT-9102; ISBN-0-904-947-28-9; ETN-92-90706) Copyright
Avail: Loughborough Univ. of Technnology, Dept. of Transport Technology, Leicestershire, LE11 3TU England

Since 1979, the British fleet began to decline, not only as a proportion of the world fleet but in absolute terms both in number of ships under the British flag and the total tonnage registered. The possible causes of the decline of the British fleet are considered. The protectionist policies developed in many countries to ensure the future of their merchant fleets are pointed out. The significance to United Kingdom economy of the continuing decline of the Merchant Navy lies in the erosion of essential maritime expertise and the asset base on which maritime activities depend. There was a turnaround in the contribution of British shipping to

the balance of payments, adding to the deficits and the drain on both trained manpower and ancillary activities associated with the operation of large fleet ships. The actions that the government can apply to help to halt the decline of the British shipping industry are suggested. The severe decline of the British Merchant Navy shows no sign of bottoming out in 1991. ESA

N92-15889*# Pittsburgh State Univ., KS. Dept. of Engineering Tech.
SPACE SYSTEM PRODUCTION COST BENEFITS FROM CONTEMPORARY PHILOSOPHIES IN MANAGEMENT AND MANUFACTURING
Russell L. Rosmait *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 05C

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N92-15934# International Atomic Energy Agency, Vienna (Austria).
AGREEMENT BETWEEN THE INTERNATIONAL ATOMIC ENERGY AGENCY, THE GOVERNMENT OF JAPAN AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA FOR THE APPLICATION OF SAFEGUARDS BY THE AGENCY TO THE BILATERAL AGREEMENT BETWEEN THOSE GOVERNMENTS CONCERNING CIVIL USES OF ATOMIC ENERGY
May 1991 1 p
(DE91-639694; IAEA-INFCIRC-119(Mod-1)) Avail: NTIS HC/MF A01

The bilateral agreement (set forth in document INFCIRC/119), between the International Atomic Energy Agency, the government of Japan, and the government of the United States of America, for the application of safeguards by the agency to the bilateral agreement between those governments concerning civil uses of atomic energy expired on 17 July 1988, following the termination of the 1968 Agreement for Co-operation. A subsequent Agreement for Co-operation between the two governments concerning peaceful uses of nuclear energy was entered into force on 17 July 1988. Under its provisions agency safeguards are to be applied with respect to past and future peaceful nuclear co-operation between Japan and the USA. DOE

N92-15935# European Space Agency, Paris (France).
THE EUROPEAN CENTRE FOR SPACE LAW Biennial Report, 1989 - 1991
Kevin Madders, Paul Tuinder, and Norman Longdon, ed. Aug. 1991 24 p Original contains color illustrations
(ESA-BR-77; ISBN-92-9092-087-4; ETN-92-90681) Copyright
Avail: NTIS HC/MF A03

The European Center for Space Law's (ECSL) first two years of activity are reported. The purpose of ECSL is to strengthen space law research in Europe. Space is becoming a domain of competition where states and private law entities are involved and new law criteria are required. The origin, the establishment and the structure of ECSL are presented. The activities of ECSL concerning seminars, lectures and colloquia are summarized. The ECSL charter is given. At the end of its first two years of existence, ECSL is on a sound organizational programmatic footing, even if one must recognize that it is still in the process of consolidation. In particular, the electronic database, the production of a growing series of publications, and the stimulation and conduct of a range of research events now function on a more or less routine basis. One can say that individual research activities are maturing. ECSL has clearly acquired its own place in the space law research community of Europe. ESA

N92-15936# Committee of Conference (U.S. Congress).
MAKING APPROPRIATIONS FOR THE DEPARTMENTS OF VETERANS AFFAIRS AND HOUSING AND URBAN DEVELOPMENT, AND FOR SUNDRY INDEPENDENT AGENCIES, COMMISSIONS, CORPORATIONS, AND OTHER OFFICES FOR THE FISCAL YEAR ENDING 30 SEPTEMBER 1992, AND FOR OTHER PURPOSES
Bob Traxler Washington GPO 1991 65 p Report to accompany H.R. 2519 presented by the Committee of Conference to the 102d Congress, 1st Session, 27 Sep. 1991
(GPO-47-291) Avail: Document Room, House of Representatives, Washington, DC 20515 HC free

Federal appropriations for the Departments of Veteran Affairs and Housing and Urban Development, and for sundry independent agencies, commissions, corporations, and offices for the fiscal year ending September 30, 1992, and for other purposes are enumerated and discussed in the context of the Committee of Conference report on H.R. 2519. One of the independent agencies is the National Aeronautics and Space Administration. For individual title, see N92-15937.

N92-15937# Committee of Conference (U.S. Congress).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION RESEARCH AND DEVELOPMENT
In its Making Appropriations for the Depts. of Veterans Affairs and Housing and Urban Development, and for Sundry Independent Agencies, Commissions, Corps., and Other Offices for the Fiscal Year Ending 30 Sep. 1992, and for Other Purposes 1991 p 51-61 (For primary document see N92-15936 06-84)
Avail: Document Room, House of Representatives, Washington, DC 20515 HC free

The Conference Committee presents its report on recommended appropriations for the National Aeronautics and Space Administration (NASA) for the fiscal year ending September 30, 1992. Items addressed by the Conference Committee include agreed upon changes, amendments, funding by program, and decisions that the Committee made regarding differences. Both NASA's ongoing programs and new initiatives are included in the list of appropriations considered. J.P.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N92-15938# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Dienstelistungsbereich.
THE ACOUSTIC FLASHLIGHT [DIE AKUSTISCHE TASCHENLAMPE]
Stephan Bruehl 1990 6 p In GERMAN Original contains color illustrations
(MBB-Z-0359-90-PUB; Rept-3/1990; ETN-92-90610) Avail: NTIS HC/MF A02

It is shown that for traveling speeds over three hundred kilometers per hour, sound radiation is determined by aerodynamical effects, e.g., by local shedding of vortices and large area boundary layer noise. In order to obtain exact information on the position and strength of these aerodynamic sources of sound on vehicle surfaces, a measurement process aiming at localizing and analyzing quantitatively quick moving sources of sound was developed. The measuring equipment is described, e.g., a directional microphone which is placed at about five meters off the roadway. Using light cabinets, the vehicle position can be

exactly determined, with regard to the measuring station at any overhaul time. ESA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N92-15871*# Florida Univ., Gainesville. Dept. of Astronomy.
DEVELOPMENT OF A MOON-BASED MAGNETOSPHERIC AND CORONAL IMAGER USING A LARGE BROADBAND ARRAY
George Lebo *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 4 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 03A

N92-15879*# Fisk Univ., Nashville, TN. Dept. of Physics.
GROUND-BASED HIGH ENERGY ASTRONOMY
Charles H. McGruder, III *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 03A

N92-15880*# University of South Alabama, Mobile. Dept. of Civil Engineering.
LUNAR TRANSIT TELESCOPE LANDER DESIGN
Husam A. Omar *In* Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship program Oct. 1991 5 p (For primary document see N92-15850 06-80)
(Grant NGT-01-008-021)
Avail: NTIS HC/MF A12 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics.*

N92-15939*# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
DYNAMICS EXPLORER GUEST INVESTIGATOR Final Report, 1 Apr. 1990 - 31 Mar. 1991
Jan J. Sojka 1991 84 p
(Grant NAGw-1547)
(NASA-CR-187822; NAS 1.26:187822) Avail: NTIS HC/MF A05 CSCL 03B

A data base of satellite particle, electric field, image, and plasma data was used to determine correlations between the fields and the particle auroral boundaries. A data base of 8 days of excellent coverage from all instruments was completed. The geomagnetic conditions associated with each of the selected data periods, the number of UV image passes per study day that were obtained, and the total number of UV images for each day are given in tabular form. For each of the days listed in Table 1, both Vector Electric Field Instrument (VEFI) electric potential data and LAPI integrated particle energy fluxes were obtained. On the average, between 8 and 11 passes of useful data per day were obtained. These data are displayed in a format such that either the statistical electric field model potential or the statistical precipitation energy flux could be superimposed. The Heppner and Maynard (1987) and Hardy et al. (1987) models were used for the electric potential and precipitation, respectively. In addition, the auroral image intensity along the Dynamics Explorer-2 satellite pass could be computed and plotted along with the LAPI precipitation data and Hardy et al. (1987) values. Author

N92-15940# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimentalnoj Fiziki.
ON THE PULSAR IN REMNANT OF SUPERNOVA 1987A. A NEW PHYSICS IN SUBMILLISECOND DOMAIN
M. I. Krivoruchenko 1989 13 p
(DE91-628562; ITEP-100-89) Avail: NTIS HC/MF A03

Recently Middleditch and colleagues reported on the observation of a pulsar in the remnant of Supernova 1987A with an unusually small period P = 0.508 ms. Limits on rotation rates of ordinary neutron stars with account taken of Bose-condensation of the most reliable lightest dibaryon resonance lambda N(2130) is obtained. The minimal rotation period of neutron stars is found to be 1.9 - 2.3 ms in the tensor interaction model of nuclear matter and 1.2 - 1.5 ms in the Reid model. The rotation periods of quark stars are greater than 0.7 - 0.9 ms. DOE

N92-15941# International Centre for Theoretical Physics, Trieste (Italy).
ON THE DETERMINATION OF THE HUBBLE CONSTANT
V. G. Gurzadyan, V. V. Harutyunyan, and A. A. Kocharyan (Academy of Sciences of the Armenian SSR, Erivan.) Oct. 1990 10 p
(DE91-625368; IC-90/316) Avail: NTIS HC/MF A02

The possibility of an alternative determination of the distance scale of the Universe and the Hubble constant based on the numerical analysis of the hierarchical nature of the large scale Universe (galaxies, clusters and superclusters) is proposed. The results of computer experiments performed by means of special numerical algorithms are represented. DOE

N92-15942# International Centre for Theoretical Physics, Trieste (Italy).
AN ALTERNATIVE APPROACH TO THE STATISTICAL INVESTIGATION OF THE LARGE-SCALE STRUCTURE OF THE UNIVERSE
V. G. Gurzadyan, V. V. Harutyunyan, and A. A. Kocharyan (Academy of Sciences of the Armenian SSR, Erivan.) Oct. 1990 10 p
(DE91-625369; IC-90/317) Avail: NTIS HC/MF A02

A method of statistical investigation of filamentary structure of the Universe is developed enabling one to analyze the information both on its spatial and dynamical properties simultaneously. The idea is based on construction of subsystems of a hierarchical system by means of special numerical algorithm. The strength of the method is demonstrated via computer experiments. DOE

N92-15943# International Centre for Theoretical Physics, Trieste (Italy).
ON TYPICAL PROPERTIES OF THE UNIVERSE IN SUPERSPACE
V. G. Gurzadyan Nov. 1990 5 p
(DE91-632512; IC-90/332) Avail: NTIS HC/MF A01

Further properties of the Typical Universe are investigated. A typical measure determined by the evolution of the Universe as a dynamical system is defined in Wheeler-DeWitt superspace. Poincare Recurrence Theorem is shown to violate for the Universe due to the fact that the measure of returning points is zero. DOE

N92-15944# Instituto de Fisica Teorica, Sao Paulo (Brazil).
PARAMETRIZATION OF THE MIXMASTER MOMENTUM VARIABLES
G. Francisco 1990 15 p
(DE91-641734; IFT-P-20/90) Avail: NTIS HC/MF A03

There has been much interest in the study of the dynamical properties of type IX cosmological models. Such studies rely on the use of Kasner stages together with an associated discretization of the orbit. In this work I argue that this discretization is essentially

1-dimensional and does not yield a complete specification of the pair of momentum variables. I show that a consistent approximation, with the correct number of parameters, can be extracted from the dynamics of separatrix transitions. In this context, it is stressed that the discretization fails to describe essential properties of this class of models. DOE

N92-15945# Instituto de Fisica Teorica, Sao Paulo (Brazil).
MIXMASTER: A WEAKLY CHAOTIC MODEL?
K. Ferraz, G. Francisco, and G. E. A. Matsas 1990 10 p
(DE91-641735; IFT-P-25/90) Avail: NTIS HC/MF A02

We discuss in which sense the Mixmaster Universe can be considered chaotic, since there are as many authors answering affirmatively as negatively to this question. Our point of view is that criteria for chaoticity based on Liapunov Exponents should not be used in the present situation. Instead, amounts of information extracted directly from physical orbits provide the adequate alternative from which this problem can be better understood. DOE

N92-15946# Sao Paulo Univ. (Brazil). Inst. de Fisica.
A MODEL OF CP VIOLATION HAVING A COSMOLOGICAL ORIGIN
H. Fleming and W. Truppel Aug. 1990 15 p
(DE91-641736; IFUSP-P-864) Avail: NTIS HC/MF A03

CP is spontaneously broken through a Higgs field conformally coupled to the open Friedmann spacetime. The effect grows as we go toward the origin of the universe, resisting to its equilibrium temperature. DOE

N92-15947# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
SPONTANEOUS SYMMETRY BREAKING IN N=2 SUPERGRAVITY WITH MATTER
Yu. M. Zinoviev 1990 25 p Submitted for publication
(DE91-639749; IHEP-OTF-90-109; IFVE-OTF-90-109) Avail: NTIS HC/MF A03

New versions of the N = 2 supergravity hidden sector have been constructed allowing spontaneous symmetry breaking without a cosmological term and with two arbitrary scales, in particular, the partial super-Higgs effect. On this basis, spontaneous symmetry breaking has been investigated in the models of N = 2 supergravity with an arbitrary number of vector and hypermultiplets. As has been shown, the possibility to get breaking without a cosmological a term is connected with the presence of nilpotent combinations of compact and non-compact generators in an isometry group of a sigma-model. DOE

N92-15948# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
AN EFFECTIVE LAGRANGIAN DESCRIPTION OF SUPERNOVA-CORE BOUNCE
H. Rodrigues, V. deAvila, S. J. B. Duarte, and T. Kodama 1990 27 p
(DE91-641690; CBPF-NF-026/90) Avail: NTIS HC/MF A03

The global dynamical aspects of a supernova event are studied in terms of an effective Lagrangian formulation. The equation of motion derived from this Lagrangian is solved numerically for different supernova core masses. An equation of state for cold matter is introduced by means of an adiabatic index parametrization which is a smooth function of the matter density. The energy transfer from the inner to the outer core is estimated in the context of the hydrodynamic bounce mechanism. It is found that only a very restricted mass distribution to pre-supernova core configuration generate a strong enough shock wave leading to a prompt bounce ejection. DOE

N92-15949# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
SPHERICALLY SYMMETRIC RELATIVISTIC MODEL FOR SPIRAL GALAXIES AND DENSE STARS
R. Hojman (Chile Univ., Santiago.), L. M. C. Rodrigues, and F. D. Sasse 1990 14 p
(DE91-641691; CBPF-NF-035/90) Avail: NTIS HC/MF A03

The behavior of the pressure and the density as well as the gravitational field of a dense star are studied in some detail. For such a purpose and to take into account relativistic effects, we find a family of exact solutions of the Tolman-Oppenheimer-Volkov equation, which contains as a particular case solutions corresponding to a (gamma)-law equation of state. The mentioned family can also be used to model the (luminous or dark) matter content of spiral galaxies as it fits the observed data for their orbital velocities profiles. DOE

N92-15950# Los Alamos National Lab., NM.
REGULATION OF THE INTERPLANETARY MAGNETIC FLUX
D. J. McComas, J. T. Gosling, and J. L. Phillips 1991 11 p Presented at the 7th Solar Wind Conference, Goslar (Germany), 16-21 Sep. 1991
(Contract W-7405-eng-36)
(DE92-002545; LA-UR-91-3377; CONF-910915-4) Avail: NTIS HC/MF A03

In this study, we use a recently developed technique for measuring the 2-D magnetic flux in the ecliptic plane to examine: (1) the long term variation of the magnetic flux in interplanetary space; and (2) the apparent rate at which coronal mass ejections (CME's) may be opening new flux from the Sun. Since there is a substantial variation (approximately 50 percent) of the flux in the ecliptic plane over the solar cycle, we conclude that there must be some means whereby new flux can be opened from the Sun and previously open magnetic flux can be closed off. We briefly describe recently discovered coronal disconnection events which could serve to close off previously open magnetic flux. CME's appear to retain at least partial magnetic connection to the Sun and hence open new flux, while disconnections appear to be likely signatures of the process that returns closed flux to the Sun; the combination of these processes could regulate the amount of open magnetic flux in interplanetary space. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N92-15951*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
DIFFERENTIAL THERMAL ANALYSIS OF LUNAR SOIL SIMULANT
D. Tucker and A. Setzer Dec. 1991 12 p
(NASA-TM-103563; NAS 1.15:103563) Avail: NTIS HC/MF A03 CSCL 03B

Differential thermal analysis of a lunar soil simulant, 'Minnesota Lunar Simulant-1' (MLS-1) was performed. The MLS-1 was tested in as-received form (in glass form) and with another silica. The silica addition was seen to depress nucleation events which lead to a better glass former. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N92-15952# International Centre for Theoretical Physics, Trieste (Italy).
NUMERICAL SIMULATION OF A MAGNETIC RECONNECTION IN THE SOLAR CORONA
Shui Wang Aug. 1990 16 p
(DE91-625352; IC-90/214) Avail: NTIS HC/MF A03

In this paper, a kind of magnetic reconnection process caused by the local heating in the closed magnetic field region over the

equator in the solar corona is discussed. At first, we use a method in combination with analytical and numerical methods to obtain a coronal magnetic configuration with an X-type neutral point. Furthermore we solve numerically the magnetohydrodynamic equations by using the full-implicit continuous Eulerian scheme in spherical coordinates. The results of numerical simulation show that three different processes of magnetic reconnection exist. On the other hand, the upward plasma velocity is small when the effect of the solar gravitational field is considered. Hence, we suggest that the magnetic reconnection caused by the pure resistivity tearing mode may be unimportant for the coronal mass ejections. DOE

N92-15953# Los Alamos National Lab., NM.
DISCONNECTION OF OPEN CORONAL MAGNETIC STRUCTURES
D. J. McComas, J. L. Phillips, A. J. Hundhausen, and J. T. Burkepile 1991 10 p Presented at the 7th Solar Wind Conference, Goslar (Germany), 16-21 Sep. 1991
(Contract W-7405-eng-36)
(DE92-002464; LA-UR-91-3342; CONF-910915-2) Avail: NTIS HC/MF A02

We have examined the Solar Maximum Mission coronagraph/polarimeter observations for evidence of magnetic disconnection of previously open magnetic structures and a number of likely examples have been found. Probable coronal disconnections typically appear as pinching off of helmet streamers followed by the release and outward acceleration of a large U or V-shaped structure. The observed sequence of events is consistent with reconnection across the heliospheric current sheet between previously open magnetic field regions, and the creation of a detached magnetic structure which is open to interplanetary space at both ends. Sunward of the reconnection point, coronal disconnection events would return previously open magnetic flux to the Sun as closed field arches. Here we (1) describe one clear disconnection event (1 June 1989); (2) examine the results of a limited survey of disconnection events; and (3) discuss the potential importance of coronal disconnections for maintaining flux in interplanetary space. DOE

N92-15954*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE COMPLETE HARD X RAY BURST SPECTROMETER EVENT LIST, 1980-1989
B. R. Dennis, L. E. Orwig, G. S. Kennard, G. J. Labow, R. A. Schwartz, A. R. Shaver, and A. K. Tolbert (ST Systems Corp., Lanham, MD.) Washington Dec. 1991 221 p
(NASA-TM-4332; NAS 1.15:4332; Rept-92B00009) Avail: NTIS HC/MF A10 CSCL 03B

This event list is a comprehensive reference for all Hard X ray bursts detected with the Hard X Ray Burst Spectrometer on the Solar Maximum Mission from the time of launch on Feb. 14, 1980 to the end of the mission in Dec. 1989. Some 12,776 events were detected in the energy range 30 to 600 keV with the vast majority being solar flares. This list includes the start time, peak time, duration, and peak rate of each event. Author

N92-15955# Los Alamos National Lab., NM.
COUNTERSTREAMING SOLAR WIND HALO ELECTRON EVENTS ON OPEN FIELD LINES?
J. T. Gosling, D. J. McComas, and J. L. Phillips 1991 9 p Presented at the 7th Solar Wind Conference, Goslar (Germany), 16-21 Sep. 1991
(Contract W-7405-eng-36)
(DE92-002544; LA-UR-91-3378; CONF-910915-3) Avail: NTIS HC/MF A02

Counterstreaming solar wind halo electron events have been identified as a common 1 AU signature of coronal mass ejection events, and have generally been interpreted as indicative of closed magnetic field topologies, i.e., magnetic loops or flux ropes rooted at both ends in the Sun, or detached plasmoids. In this paper, we examine the possibility that these events may instead occur preferentially on open field lines, and that counterstreaming results from reflection or injection behind interplanetary shocks or from mirroring from regions of compressed magnetic fields farther out in the heliosphere. We conclude that neither of these suggested sources of counterstreaming electron beams is viable and that the best interpretation of observed counterstreaming electron events in the solar wind remains that of passage of closed field structures. DOE

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N92-15956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TRANSPORT METHODS AND INTERACTIONS FOR SPACE RADIATIONS
John W. Wilson, Lawrence W. Townsend, Walter S. Schimmerling, Govind S. Khandelwal, Ferdous S. Khan, John E. Nealy, Francis A. Cucinotta, Lisa C. Simonsen, Judy L. Shinn, and John W. Norbury (Rider Coll., Lawrenceville, NJ.) Washington Dec. 1991 615 p
(NASA-RP-1257; L-16882; NAS 1.61:1257) Avail: NTIS HC/MF A99 CSCL 03B

A review of the program in space radiation protection at the Langley Research Center is given. The relevant Boltzmann equations are given with a discussion of approximation procedures for space applications. The interaction coefficients are related to solution of the many-body Schroedinger equation with nuclear and electromagnetic forces. Various solution techniques are discussed to obtain relevant interaction cross sections with extensive comparison with experiments. Solution techniques for the Boltzmann equations are discussed in detail. Transport computer code validation is discussed through analytical benchmarking, comparison with other codes, comparison with laboratory experiments and measurements in space. Applications to lunar and Mars missions are discussed. Author

N92-15957# International Centre for Theoretical Physics, Trieste (Italy).
CAN THE ANISOTROPY OF MICROWAVE BACKGROUND RADIATION BE DISCOVERED AT PRESENT?
V. G. Gurzadyan and A. A. Kocharyan (Academy of Sciences of the Armenian SSR, Erivan.) Oct. 1990 12 p
(DE91-625370; IC-90/318) Avail: NTIS HC/MF A03

An effect leading to a decrease of perturbations of Microwave Background Radiation after recombination epoch is investigated. Behavior of correlation functions for null geodesics flow enables one to evaluate the role of this effect based purely on geometrical and topological properties of the Universe. Possible anisotropy of MwB in open Friedmannian Universe is shown to decrease due to this effect to a level far below present experimental accuracy. The fractal nature of the large scale structure of the Universe is also discussed. DOE

N92-15958# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
ON THE DIFFUSION OF THE HADRONIC COMPONENT OF THE COSMIC RAYS AND SEMI-GROUPS
F. M. deOliveiraCastro 1990 9 p
(DE91-641744; CBPF-NF-022/90) Avail: NTIS HC/MF A02

Semigroup theory is used to integrate the diffusion of hadrons in the atmosphere. DOE

N92-15959*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HZETRN: A HEAVY ION/NUCLEON TRANSPORT CODE FOR SPACE RADIATIONS
John W. Wilson, Sang Y. Chun, Forooz F. Badavi, Lawrence W.

Townsend, and Stanley L. Lamkin (Analytical Services and Materials, Inc., Hampton, VA.) Dec. 1991 47 p
(NASA-TP-3146; L-16952; NAS 1.60:3146) Avail: NTIS HC/MF A03 CSCL 03B

The galactic heavy ion transport code (GCRTRN) and the nucleon transport code (BRYNTRN) are integrated into a code package (HZETRN). The code package is computer efficient and capable of operating in an engineering design environment for manned deep space mission studies. The nuclear data set used by the code is discussed including current limitations. Although the heavy ion nuclear cross sections are assumed constant, the nucleon-nuclear cross sections of BRYNTRN with full energy dependence are used. The relation of the final code to the Boltzmann equation is discussed in the context of simplifying assumptions. Error generation and propagation is discussed, and comparison is made with simplified analytic solutions to test numerical accuracy of the final results. A brief discussion of biological issues and their impact on fundamental developments in shielding technology is given. Author

99 GENERAL

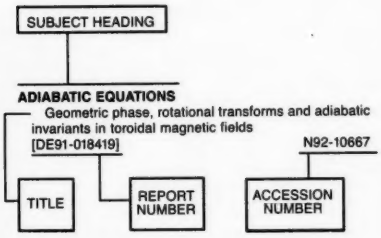
N92-15960# National Science Foundation, Washington, DC. Div. of Industrial Science and Technological Innovation.
ABSTRACTS OF PHASE 1 AWARDS. NSF SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR), 1990
1990 71 p
(NSF-90-133) Avail: NTIS HC/MF A04

The National Science Foundation (NSF) solicits research proposals from small science- and technology-based firms with 500 or fewer employees. This publication contains abstracts of Phase 1 awards made under the NSF's Small Business Innovation Research (SBIR) Program in 1990 as a result of the 1989 solicitation. SBIR supports creative advanced research in important scientific and engineering areas and is designed to encourage the conversion of that R&D into technical innovation and commercial applications. SBIR helps to convert research-based ideas to prototypes. In addition to the abstracts, this report contains a description of potential commercial applications of the research, describes how the follow-on funding commitment works, and gives information on rights to data developed under SBIR and on copyright and patent policy. Potential commercial applications of the research are described by the awardees. NSF encourages direct contact with the business officials of the SBIR grantees whose names, addresses, and telephone numbers are listed in the back of this publication. J.P.S.

N92-15961# European Space Agency, Paris (France).
[ACTIVITIES REPORT OF THE EUROPEAN SPACE AGENCY] Annual Report, 1990
Norman Longdon, ed. and T. D. Guyenne, ed. 1991 217 p
Original contains color illustrations
(ISSN-0258-025X; ETN-92-90679) Copyright Avail: NTIS HC/MF A10

The scientific and technical projects developed by ESA in 1990 are summarized. The following programs are discussed: Hubble Space Telescope, Ulysses, solar observatory, Giotto mission, Huygens mission, Earth observation, telecommunication, Columbus, microgravity, and European astronauts corps. The results from scientific and technological research are presented. Data handling and technical infrastructure facilities, which are ESA basic activities, are included. Concerning the installations, the following projects are discussed: ESAMET, computer systems, ground facilities for space systems, mission support, satellite operations, and ESA establishments. The ESA administrative organization and structure are summarized. ESA finance, contracts and international relations are reported. ESA

Typical Subject Index Listing



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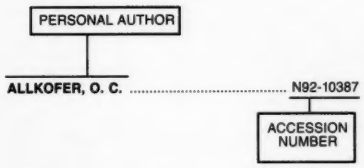

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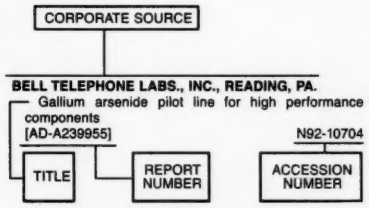

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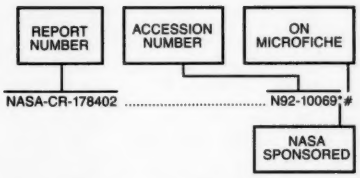

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JINR-R-2-90-287 ..... N92-15700 #
JINR-R-3-89-1 ..... N92-15792 #
JINR-R-4-89-96 ..... N92-15312 #
JINR-R-4-89-561 ..... N92-15698 #
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JINR-R-9-90-440 ..... N92-15199 #
JINR-R-13-89-390 ..... N92-15738 #
JINR-R-15-89-338 ..... N92-15767 #
JINR-R-16-89-401 ..... N92-15695 #

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KFTI-89-4 ..... N92-15209 #
KFTI-89-5 ..... N92-15740 #

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L-16882 ..... N92-15956* #
L-16952 ..... N92-15959* #

LA-UR-91-2861 ..... N92-15126 #
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LA-UR-91-3140 ..... N92-15506 #
LA-UR-91-3141 ..... N92-15817 #
LA-UR-91-3160 ..... N92-15167 #
LA-UR-91-3224 ..... N92-15818 #
LA-UR-91-3266 ..... N92-15375 #
LA-UR-91-3342 ..... N92-15953 #
LA-UR-91-3377 ..... N92-15950 #
LA-UR-91-3378 ..... N92-15955 #

LA-11868-MS ..... N92-15293 #
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MBB-Z-0359-90-PUB ..... N92-15938 #

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MEMO-INF-91-51 ..... N92-15560 #
MEMO-INF-91-52 ..... N92-15561 #

MEMO-930 ..... N92-15631 #
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MEMO-947 ..... N92-15635 #
MEMO-953 ..... N92-15636 #
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MITT-80 ..... N92-15510 #

MTL-TR-91-36 ..... N92-15592 #
MTL-TR-91-37 ..... N92-15172 #

MTR-11023 ..... N92-15058 #

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MZ-TH/91-17 ..... N92-15827 #

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NAS 1.21:7037(271) N92-14967*
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NCEL-CR-91.009 N92-15485 #

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NEDO-P-8810-PT-2 N92-15423 #

NIFS-PROC-4 N92-15756 #

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NIIYAF-MGU-90-7-153-PT-1 N92-15115 #
NIIYAF-MGU-90-11-157 N92-15676 #
NIIYAF-MGU-90-38-184 N92-15845 #

NIKHEF-H/91-01 N92-15703 #
NIKHEF-H/91-02 N92-15704 #
NIKHEF-H/91-03 N92-15824 #
NIKHEF-H/91-05 N92-15825 #
NIKHEF-H/91-08 N92-15826 #
NIKHEF-H/91-09 N92-15827 #
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NIKHEF-H/91-11 N92-15744 #

NLR-TP-90084-U N92-15065 #
NLR-TP-90123-U N92-15064 #

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NMERI-SS-2-03-(1) N92-15202 #

NOARL-TN-144 N92-15684 #
NOARL-TN-163 N92-15508 #

NOSC/TD-2116 N92-15913 #

NP-107/10-88 N92-15113* #

NPL-DES-103 N92-15361

NPL-DMM(A)-28 N92-15133

NPL-MOM-105 N92-15753

NPL-RSA(EXT)-24 N92-15319 #

NPS-AS-91-04 N92-15597 #
NPS-AS-91-05 N92-15596 #

NPS-MA-91-013 N92-15513 #

NPS-ME-91-03 N92-15110 #

NPS-53-91-013 N92-15513 #

NREL/TP-214-4433 N92-15796 #
NREL/TP-257-4419 N92-15134 #
NREL/TP-257-4512 N92-15396 #

NRL-MR-6793 N92-15365 #
NRL-MR-6913 N92-15112 #

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NRL-9360 N92-15111 #

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NSF-90-113 N92-15909 #
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NSF-90-151 N92-15498 #
NSF-90-301 N92-15906 #
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PL-TR-91-2107 N92-15059 #
PL-TR-91-2180 N92-15483 #
PL-TR-91-2187 N92-15502 #

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PSC-11 N92-15380 #

RAL-91-049 N92-15706 #
RAL-91-051 N92-15707 #

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REPT-88-44 N92-15562 #
REPT-90-82 N92-15638 #
REPT-90-83 N92-15562 #
REPT-90-026 N92-15581
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RL-TR-91-177 ..... N92-15545 #
RL-TR-91-231 ..... N92-15919 #
RL-TR-91-252 ..... N92-15300 #
RL-TR-91-301 ..... N92-15624 #
RL-TR-91-305 ..... N92-15390 #

RUU-CS-91-7 ..... N92-15571 #
RUU-CS-91-12 ..... N92-15648 #
RUU-CS-91-13 ..... N92-15572 #
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S-HRG-102-270 ..... N92-15078 #

SAND-91-0242C ..... N92-15149 #
SAND-91-0433C ..... N92-15424 #
SAND-91-0862 ..... N92-15427 #
SAND-91-0995C ..... N92-15790 #
SAND-91-1124 ..... N92-15392 #
SAND-91-1131C ..... N92-15363 #
SAND-91-1168 ..... N92-15612 #
SAND-91-1436C ..... N92-15429 #
SAND-91-1773C ..... N92-15118 #
SAND-91-1932C ..... N92-15746 #
SAND-91-1965C ..... N92-15332 #
SAND-91-2189C ..... N92-15056 #
SAND-91-2257C ..... N92-15554 #

SC-MAG-328 ..... N92-15736 #

SCT-90RR-44 ..... N92-15061 #

SIP-0037 ..... N92-15786 #

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SR-1 ..... N92-15502 #
SR-3 ..... N92-15483 #

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SR90-R-5253-76 ..... N92-15385 #

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SSCL-505 ..... N92-15311 #

SSL-024 ..... N92-15782 #

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SU-SOL-91-11 ..... N92-15664 #

SUNY/AB-TR-30 ..... N92-15808 #

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TEES-AERO-91-1 ..... N92-15080* #

TIOS-91/012 ..... N92-15559 #
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TR-2 ..... N92-15182 #
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TR-53 ..... N92-15187 #
TR-91-11 ..... N92-15917 #
TR-91-16 ..... N92-15580 #
TR-912 ..... N92-15308 #

TR91-1257 ..... N92-15614* #

TT-9102 ..... N92-15933

UAH-ME-91-101 ..... N92-15123* #

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UCRL-JC-105397 ..... N92-15794 #
UCRL-JC-107200 ..... N92-15372 #
UCRL-JC-107204 ..... N92-15373 #
UCRL-JC-108495 ..... N92-15754 #

UCRL-108170 ..... N92-15165 #

UDR-TR-90-108 ..... N92-15053 #
UDR-TR-91-76 ..... N92-15171 #

UILU-ENG-92-2547 ..... N92-15378* #

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US-PATENT-APPL-SN-722804 ..... N92-15206 #
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US-PATENT-CLASS-60-243 ..... N92-15122*
US-PATENT-CLASS-60-259 ..... N92-15122*
US-PATENT-CLASS-62-461 ..... N92-15203*
US-PATENT-CLASS-89-8 ..... N92-15081*
US-PATENT-CLASS-89-36.02 ..... N92-15114*
US-PATENT-CLASS-89-36.11 ..... N92-15114*
US-PATENT-CLASS-124-3 ..... N92-15081*
US-PATENT-CLASS-244-63 ..... N92-15081*
US-PATENT-CLASS-244-158R N92-15114*
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